B.S. Abdur Rahman

Crescent

Institute of Science & Technology

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

Regulations 2019 Curriculum and Syllabi

(Amendments updated upto February 2022)

M.C.A.
(Master of Computer Applications)

REGULATIONS 2019

CURRICULUM AND SYLLABI

(Amendments updated up to February 2022)

M.C.A.
MASTER OF COMPUTER APPLICATIONS

VISION AND MISSION OF THE INSTITUTION

VISION

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

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

VISION AND MISSION OF
THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

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

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.

- To focus on teaching - learning, research and consultancy to promoteexcellence in computer applications.

- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.

- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.

- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives of MCA (Master of Computer Applications) describe the accomplishments that the programme is preparing graduates to achieve.

PEO-1: To provide students with a solid foundation in mathematics and computing fundamentals required to analyse, apply, solve real time problems and pursue higher studies & research.

PEO-2: To provide technical knowledge in various programming languages and train them to comprehend, analyse, design and create innovative computing solutions for real time problems.

PEO-3: To prepare the students for a prolific career in IT and inculcate an urge for self-learning by providing an ambient environment to improve personality, excellence, leadership and spiritual values in all activities throughout the career.

PEO-4: To foster and provide a social environment which molds the students to become professionally enriched with communication, technical and innovative skills to meet the dynamic needs of industry and society.

PROGRAMME OUTCOMES (POs)

The programme outcomes of MCA describe the acquirement of students as they progress through the programme.

PO1: Apply the knowledge of computing fundamentals and mathematical concepts in computer programming.

PO2: Identify, formulate, analyze and implement mathematics and technical skills to solve real time problems.

PO3: Design and develop the software to meet out the customer and industry needs.

PO4: Pursue research based and industry-oriented projects to provide valid conclusions for complex problems.

PO5: Use latest software and tools for solving problems and satisfy the dynamic needs of industry and society.

PO6: Become a software professional with social responsibilities and ethical values.

PO7: Solve societal and environmentally sensitive problems in professionalmanner.

PO8: Demonstrate knowledge of professional and ethical responsibilities.

PO9: Function as individual member or leader of team and able to manage projects in the software development process.

PO10: Comprehend, write effective reports and communicate their innovations and idea in an effective way.

PO11: Adapt self-learning using their learning abilities.

PO12: Develop as entrepreneur in the software domain through innovative approach and excel in placement activities.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates of the department will attain the ability

PSO1: To analyze, design and develop skills for real-time/industry or research projects in cloud computing /mobile applications / Data analytics technologies with vertical specialization.

PSO2: To design and develop software products/services/solutions using appropriate tools and techniques for real time mobile, desktop and web applications.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.

REGULATIONS - 2019 FOR
M.Tech. / MCA / M.Sc. / M.Com. DEGREE PROGRAMMES
(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

"Programme" means Post Graduate Degree Programme (M.Tech. / MCA / M.Sc. / M.Com.)

"Course" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.,

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

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

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

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	

2.2   ADMISSION REQUIREMENTS

2.2.1   Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

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

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

3.1.   The minimum and maximum period for completion of the Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	4	8
M.Com.	4	8

3.1.1   Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

3.1.2   Medium of instruction, examinations and project report shall be in English.

3.2   ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Qualifications for admission
1.	Aeronautical Engineering	M. Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	Civil Engineering	M. Tech. (Structural Engineering)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch.

3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg.)	B.E. / B. Tech. (EEE/ECE/E&I/I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Data Science)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)
9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA

		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences
		M.Tech. Food Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences
14.	Commerce	M.Com	Candidates who have passed B.Com/BBA degree (General or any Specialization) of this Institution or authority accepted by this Institution as equivalent thereto.

3.3. STRUCTURE OF THE PROGRAMME

3.3.1 The PG programmes consist of the following components as prescribed in the respective curriculum

    i. Core courses

    ii. Elective courses

    iii. Laboratory oriented core courses

    iv. Project work / thesis / dissertation

    v. Laboratory Courses

    vi. Seminars

    vii. Mini Project

    viii. Industrial Internship

    ix. Value Added Courses

    x. MOOC Courses (NPTEL, SWAYAM, etc.,)

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum of programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	74 - 80
MCA (3 years)	118 - 126
MCA (Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77 - 82
M.Com.	88

3.3.5 Credits will be assigned to the courses for all programmes as given below:

❖ One credit for one lecture period per week or 15 periods of lecture per semester

❖ One credit for one tutorial period per week or 15 periods per semester

❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester

❖ One credit for four weeks of industrial internship or 160 hours per semester.

3.3.6 The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval

of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

3.4. ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the faculty member.

3.5 PROJECT WORK / DISSERTATION

3.5.1 Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD / Dean of School as Class Advisor for the whole class. He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general

counseling on the academic programme, the Head of the Department / Dean of School of the students shall attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment in every semester.

5.0 CLASS COMMITTEE

5.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

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

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

5.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

5.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

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

6.0 COURSE COMMITTEE

6.1 Each common theory / laboratory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as course coordinator. The

nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0 REGISTRATION AND ENROLLMENT

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

7.2 For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

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

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

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA (3 years)	45

MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18
M.Com	NA

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 ATTENDANCE

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

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year. However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.4 A student shall register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be chosen with the approval of Head of the Department / Dean of School.

11.0 REDO COURSES

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

during regular semesters, without affecting the regular academic schedule and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

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

12.0 ASSESSMENTS AND EXAMINATIONS

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

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

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

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

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

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

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research

organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

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

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for

supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

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

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

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevented from appearing for semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

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

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

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of

Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the ith course and GP_i is the Grade Point in the ith course

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

Where n = number of courses

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

"I" and "W" grades are excluded for calculating GPA.

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

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

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained 'U' or 'I' grade in any course during his/her period of study and

should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0 DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:
   i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
   ii. No disciplinary action is pending against him/her.
   iii. Enrolled and completed at least one value added course.
   iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0 POWER TO MODIFY

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

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE ANDTECHNOLOGY

REGULATIONS 2019, CURRICULUM & SYLLABI
MASTER OF COMPUTER APPLICATIONS
(FOUR SEMESTERS / FULL TIME)
(Candidates admitted from the academic year 2020-21 onwards)

SEMESTER I

S. No.	Course Group	Course Code	Course Title	L	T	P	C
1	MS	MAD 6188	Mathematical Foundation forComputer Applications	3	1	0	4
2	PC	CAD 6121	Computer Organization and Operating system	3	0	0	3
3	PC	CAD 6122	Database Management Systems	3	0	0	3
4	PC	CAD 6123	Computer Networks	3	0	0	3
5	PC	CAD 6124	Data structures and Algorithms using C/C++	3	0	0	3
6	ES	CAD6125	Object Oriented Software Engineering	3	0	0	3
7	PC	CAD 6126	Data structures and Algorithms Laboratory using C/C++	0	0	2	1
8	PC	CAD 6127	Programming in C and C++ Laboratory	0	0	2	1
9	PC	CAD 6128	DBMS Laboratory	0	0	2	1

22

SEMESTER II

S. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	CAD 6221	Programming in Java	3	0	0	3
2	MS	CAD 6222	Resource Management Techniques	3	1	0	4
3	PC	CAD 6223	Cloud Computing	3	0	0	3
4	PC	CAD 6224	Mobile Application Development	3	0	0	3
5	PC	CAD 6225	Introduction to Data Science	3	0	0	3
6	PE		Elective I	3	0	0	3
7	PC	CAD 6226	Communication Skills Laboratory	0	0	2	1
8	PC	CAD 6227	Advanced Technology Laboratory (Cloud/Mobile/Data Science)	0	0	2	1
9	PC	CAD 6228	Programming in JAVA Laboratory	0	0	2	1
							22

SEMESTER III

S. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	CAD 7121	Python Programming	3	0	0	3
2	PC	CAD 7122	Block Chain Technology	3	0	0	3
3	PC	CAD 7123	Big Data Analytics	3	0	0	3
4	PC	CAD 7124	Machine Learning Techniques	3	0	0	3
5	PC	CAD 7125	Advanced Web Development andServices	3	0	2	4
6	PE		Elective – II	3	0	0	3
7	MGT	CAD 7126	Customer Relationship Management	3	0	0	3
8	PC	CAD 7127	Python Programming Laboratory	0	0	2	1
9	PI	CAD 7128	Mini Project	0	0	2	1
							24

SEMESTER IV

S. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PI	CAD 7221	Project				18

TOTAL CREDITS : 86

Note (Mandatory Course for completion of degree):
- Students must have enrolled and completed at least one value addedcourse.
- Also enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

PROGRAMME ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C
		SEMESTER II				
1	CADY 251	Digital Marketing	3	0	0	3
2	CADY 252	Management Information Systems	3	0	0	3
3	CADY 253	Multimedia Systems and Computer Graphics	3	0	0	3
4	CADY 254	Organizational Behaviour	3	0	0	3
5	CADY 255	Cyber Security	3	0	0	3
		SEMESTER III **Mobile Applications**				
1	CADY 352	Mobile Security	3	0	0	3
2	CADY 353	Mobile and Digital Forensics	3	0	0	3

Cloud Technology

| 3 | CADY 357 | Cloud Security | 3 | 0 | 0 | 3 |
| 4 | CADY 358 | Information Storage and Management | 3 | 0 | 0 | 3 |

Web Applications and Development

5	CADY 360	Content Management System	3	0	0	3
6	CADY 361	PHP Programming	3	0	0	3
7	CADY 371	Full Stack Development	3	0	0	3

Big data

| 8 | CADY 364 | Data Analytics and Visualization | 3 | 0 | 0 | 3 |
| 9 | CADY 367 | R Programming | 3 | 0 | 0 | 3 |

SEMESTER I

MAD 6188	MATHEMATICAL FOUNDATION FOR	L	T	P	C
SDG: 9	COMPUTER APPLICATIONS	3	1	0	4

COURSE OBJECTIVES:

COB1: Provide mathematical background on Number System and Combinatorics.

COB2: Give Sufficient exposure to Propositions and Logical operations.

COB3: Deal and solve problems on Matrices.

COB4: Familiarize the concepts in Set Theory.

COB5: Explain the concepts in Graph Theory.

MODULE I   NUMBER SYSTEMS, COMBINATORICS   12

Decimal Number System - Binary Number System - Hexadecimal Number System - Octal Number System - Permutations and Combinations - Mathematical Induction - Pigeonhole principle.

MODULE II   PROPOSITIONS AND LOGICAL OPERATIONS   12

Notation - Connections - Normal forms - Truth Tables - Equivalence and Implications - Theory of inference for statement calculus, Predicate calculus - Rules of Logic Mathematical Induction and Quantifiers.

MODULE III   MATRICES   12

Matrices: Definition and Classification - Algebra of Matrices - Special Matrices - Elementary Operations of a Matrix. Determinants: Definitions & Properties - Minors and Cofactors -Operations on Determinants -Determinants: System of Linear Equations-Characteristic Equation- Eigen values and Eigenvectors.

MODULE IV   SETS AND RELATIONS   12

Basic concepts of Sets - Set Operations and Venn Diagrams - Set Identities Cartesian products - Power sets - Representation and Properties of Relations.

MODULE V   GRAPH THEORY   12

Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut- Sets.

L – 45; T – 15; TOTAL HOURS –60

TEXT BOOKS:
1. Judith L. Gersting, "Mathematical Structures for Computer Science", W.H. Freeman and Company, 7th Edition , New York, 2014.
2. Grimaldi R.P. and Ramana B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, Harlow, 2006.
3. Veerarajan.T., "Engineering Mathematics" Tata McGraw Hill Publishing Co., 5th edition, New Delhi, 2012.

REFERENCES:
1. Grimaldi R.P. and Ramana B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, Harlow, 2006.
2. Trembley.J.P and Manohar R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw – Hill Publishing Company Limited, Reprint, New Delhi, 2008.

COURSE OUTCOMES:

CO1: Explain the concepts in Mathematical Induction, Set Theory, Graph theory.

CO2: Demonstrate the use of Matrices in solving linear equations.

CO3: Apply the Combinatorics, Proposition, Logical Operators involving combinatorics problems.

CO4: Solve logical proofs in Mathematical Logics derived from truth tables.

CO5: Apply set operations and functions in solving in Set Problem.

Board of Studies (BoS) :

14th BoS of CA held on 06.06.2020

Academic Council:

15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H											M		
CO2	H	H									M		M		
CO3	H	H				L							M		
CO4	H	H										L	M		
CO5	H	H		L									M		

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The learner will be able to identify the problem of concern; then, build a quantitative mathematical model, analyse and solve it, apply the results, and potentially create appropriate mathematical software that can be commercialized.

CAD 6121

SDG: 9

	COMPUTER ORGANIZATION AND	L	T	P	C
	OPERATING SYSTEM	3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to

COB1: Introduce the instruction sets and operations of processor.

COB2: Explain the functions and services of Memory and I/O devices.

COB3: Provide an understanding of the major operating system components, services and functions.

COB4: Describe various features of processes and present both software and hardware solutions of the critical section problems.

COB5: Explore the techniques for managing both memory and files.

**MODULE I   INTRODUCTION   TO   COMPUTER   9
                 ORGANIZATION**

Functional Units of a Digital Computer: Von Neumann Architecture – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes- Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.

MODULE II   MEMORY AND I/O   9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel And Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

MODULE III   INTRODUCTION TO OPERATING SYSTEMS   9

Role of an Operating System – Types of Operating System – Major OS Components – Operating System Operations – Operating System Services – System calls – System Programs – Operating System Structure – Process Concept – Process Scheduling – Operations on Processes – Inter process Communication.

MODULE IV   PROCESS MANAGEMENT   9

.Basic Concepts of Scheduling – Scheduling Criteria – Scheduling Algorithms – FCFS – SJF – Round Robin -Critical Section Problem – Semaphores – Monitors – Dining Philosophers Solutions Using Monitors – Implementation of Monitor Using

Semaphores.

MODULE V   MEMORY AND FILE MANAGEMENT   9

Swapping – Contiguous Memory Allocation – Paging – Segmentation – Virtual Memory – Demand Paging – Copy-on-Write – File system Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.-File System Implementation- Case study of Linux and Window operating systems.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.
3. Abraham Silberschatz, Peter B galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons Inc., 2013.
4. Deitel H M, "Operating Systems", 3rd Edition, Pearson education India, New Delhi, 2015.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Adison Wesley, 2009.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Analyze the structure of a digital computer and demonstrate programming proficiency using the various addressing modes and the different control systems.

CO2: Analyze the performance of processors and caches

CO3: Describe the functioning of memory and operations of Input/output Organization

CO4: Explain the basic structure and functions of operating systems

CO5: Identify the problems related to process management and synchronization and apply learned methods to solve basic problems.

Board of Studies (BoS):   **Academic Council:**

14th BoS of CA held on 06.06.2020   15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 9	PO 11	PO 12	PS O1	PS O2
CO1	H							M					H	H
CO2		M							H				M	
CO3				M										H
CO4	H												H	
CO5		H			M			M	H			M		H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable, industrialization and foster innovation.

The learner would be able to introduce the open source operating systems and build the computerized ecosystem for the enterprise in a cost effective manner. The outcomes of the course are measurable and would enable the learner to be productive in industrialization process with innovative computerization ideas. .

CAD 6122

SDG: 4

DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

COB1: Introduce the basics on database and its operations.

COB2: Impart the fundamentals of relational database and process to formulate, analyze database queries.

COB3: Use of latest software to develop database projects and apply normalization techniques.

COB4: Educate the concept of database storage & file structure.

COB5: Comprehend ways of executing transactions in an effective and ethical way**.**

MODULE I   **INTRODUCTION**   **9**

Database Systems vs. File Systems - View of Data - Data Models-Database Languages -Transaction Management - Database Systems Structure - History of Database Systems - Database Systems Applications - Entity Relationship Model.

MODULE II   **RELATIONAL DATABASES**   **9**

SQL - Basic Structure - Set Operations - Complex Queries - Joined Queries - DDL- Embedded SQL-Dynamic SQL-Other SQL Functions - Query by Example-Integrity and Security of searching - Relational Database Design.

MODULE III   **NORMALIZATION & QUERY EVALUATION**   **9**

Normalization – Introduction - Non loss decomposition and functional dependencies – First - Second and third normal forms – dependency preservation – Boyce - Codd normal form - Higher Normal Forms – Multi valued dependencies and Fourth normal form - Join dependencies and Fifth normal form - Query Processing - Selection Operation - Sorting - Join Operation – Views- E valuation of Expressions-Query Optimization.

MODULE IV   **DATA STORAGE AND INDEXING**   **9**

Storage & File Structure-RAID–File Organization–Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Btree Index Files – Static Hashing – Dynamic Hashing.

MODULE V   **TRANSACTION MANAGEMENT**   **9**

Transaction Concept - Static Implementation-Concurrency Control – Protocols - Deadlock Handling-Recovery Systems-Recovery with Concurrent Transactions - Shadow Paging - Buffer Management-Case Studies-Oracle- Microsoft SQL

Server- NOSQL – Characteristics - major types of NOSQL databases - NOSQL Database-as-a- Service for Web and mobile applications

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Data Base System Concepts", McGraw- Hill, 6th Edition, 2011
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2016.

REFERENCE BOOKS:

1. Raghu Ramakrishnan & Johannes Gerhrke, "Data Base Management Systems", McGraw Hill International 3rd Edition, 2014.
2. An Introduction to Database systems, C.J. Date, A. Kannan, S. Swami Nadhan, Pearson, Eight Edition.

COURSE OUTCOMES:

CO1: Apply and deploy the importance of DBMS in comparison with traditional file system.

CO2: Illustrate the working of a relational database.

CO3: Construct and normalize conceptual data models, analyze the normalization technique and study the different views of the database.

CO4: Implement the concepts of data storage, query evaluations and optimization techniques.

CO5: Handle transaction management queries in SQL in real time scenario

Board of Studies (BoS):
14thBoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H		M										M	
CO2			H		M								M	
CO3				H	M									L
CO4	H	H											M	
CO5						H					H			H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Database concepts taught in this course helps the student to learn about the back-end storage. Transactions and their working procedure in a real time scenario will help them to design a correct database through which efficient management of data can be done. Acquiring knowledge in database will help the student to meet the requirement for the DBA position.

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CAD 6123   **COMPUTER NETWORKS**   L   T   P   C

SDG: 8,9   3   0   0   3

COURSE OBJECTIVES:

COB1: Provide students with enough knowledge in networking, various types of networks and its applications.

COB2: Introduce the issues of data link protocols including encoding, framing, and error detection

COB3: Explain various switching and routing techniques

COB4: Provide essential knowledge about Transport layer issues

COB5: Explore the technologies of Software Defined Networking (SDN), Network Functions Virtualization (NFV)

MODULE I   INTRODUCTION   9

Building a network – Requirements – Network Architecture: – OSI Model – Internet Architecture – Direct Link Networks – Hardware building blocks – Framing – Error detection – Reliable transmission.

MODULE II   NETWORK FUNDAMENTALS   9

LAN Technology – LAN Architecture – BUS/Tree – Ring – Star – Ethernet – Token Rings – Wireless Technologies: Examples, Types of connections, Media and latest technologies.

MODULE III   NETWORK LAYE   9

Packet Switching – Switching and Forwarding – Bridges and LAN switches – Internetworking – Simple Internetworking – Routing: Types of Routing, Internet routing and protocols.

MODULE IV   TRANSPORT LAYER   9

Reliable Byte Stream (TCP) – Simple Demultiplexer (UDP) – TCP Congestion Control – Congestion Avoidance Mechanisms.

MODULE V   PRESENTATION   LAYER   and   9
**   APPLICATIONS**

Presentation formatting – Data compression – Cryptographic Algorithms: RSA - DES –– Applications – Domain Name Service – Email - SMTP – MIME –HTTP – SNMP-Introduction to Software Defined Networking(SDN) and Network Functions Virtualization(NFV)- SDN Fundamentals

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, Fifth Edition, 2011.

REFERENCES:

1. Erik Dahl man, Stefan Parkville, Johan Skold, "5G NR: The Next Generation Wireless Access Technology, Academic Press, 09-Aug 2018

2. James F. Kurose and Keith W. Ross, "Computer Networking - A Top Down Approach featuring the Internet", Addison Wesley Publishing Company, 4th Edition, 2007

3. William Stallings, "Data and Computer Communications", PHI, 7th Edition, 2011

4. Andrew S. Tanenbaum, "Computer Networks", Tata Mcgraw Hill, 5th Edition, 2013.

COURSE OUTCOMES:

CO1: Identify and describe the layers of the OSI and TCP/IP.

CO2: List the applications of wireless network technologies

CO3: Make effective use of networking topologies.

CO4: Identify the requirements for different network architecture.

CO5: Summarize the features of an emerging paradigm software defined networking (SDN) in computer networking

Board of Studies (BoS) :
14th BoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		M												H
CO2		M	H										H	H
CO3			L		M								H	
CO4				L			H							
CO5								M						H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 8: Decent Work and Economic Growth – Promote sustained, inclusive and sustainable economic growth, full and productive employment and

decent work for all

SDG 9 : Industry, Innovation and Infrastructure – Build resilient infrastructure promote inclusive and sustainable industrialization and foster innovation Building the next generation of ICT infrastructure will power the evolution of smart, sustainable cities and communities worldwide. Making modern ICTs more widely available will foster the local innovation needed to spur domestic economic growth, provide decent work and reduce inequalities.

CAD 6124	DATA STRUCTURES AND	L	T	P	C
SDG: 9	ALGORITHMS USING C / C++	3	0	0	3

COURSE OBJECTIVES:

COB1: Study the importance of data structures in context of writing efficient programs.

COB2: Explore the different types of searching and sorting algorithms.

COB3: Explain basic data structures such as arrays, linked lists, stacks and queues.

COB4: Introduce various algorithmic techniques to solve the problems.

COB5: Demonstrate the appropriate data structure and algorithm design method for a specified application.

MODULE I   INTRODUCTION TO DATA STRUCTURES   9

Introduction to data structures, Classifications: Primitive and non primitive, Dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Memory allocation functions: malloc(), calloc(), free() and realloc().Stack- Operations on stack: Infix, Prefix and Postfix notations- Conversion from Infix to postfix. Queue- Types of queue - Operations on Queue.

MODULE II   LINKED LIST AND ITS OPERATIONS   9

Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, Doubly linked list, Circular linked list, Operations on singly linked list: Creation, Insertion, Deletion, Search and Display.

MODULE III   SEARCHING AND SORTING   9

Searching - Linear Search Methods - Binary Search Methods, Sorting - Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.

MODULE IV   TREE AND GRAPH   9

Tree - Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and Post order. Graphs, Definition - Breadth-first traversal-Shortest - path algorithms– Minimum Spanning tree– Prim's and Kruskal's algorithms–Depth-first traversal.

MODULE V   ALGORITHM ANALYSIS AND DESIGN   9

Algorithm design techniques: Greedy algorithms, Divide and conquer, Dynamic programming, Backtracking, Branch and bound, Introduction to algorithm analysis: Asymptotic notations, Asymptotic Notations and its properties – Mathematical analysis for Recursive algorithm and Non-recursive algorithms. Time and space complexity of an algorithm.

                                        L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Tanenbaum A.S, Langram Y, Augestein M.J, "Data Structures using C" Pearson Education, 2004.
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill, 1st edition, July 2017

REFERENCES:

1. Robert Kruse, Data Structures and program designing using 'C', 3rd edition,
2. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006.

COURSE OUTCOMES:

CO1: Describe how arrays, records, stack, queues are represented in memory.

CO2: Compare and contrast various sorting and searching techniques.

CO3: Evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

CO4: Demonstrate different methods for traversing trees.

CO5 : Apply suitable shortest path algorithm in appropriate applications

Board of Studies (BoS) :   **Academic Council:**

14th BoS of CA held on 06.06.2020   15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 11	PSO 1	PSO 2
CO1		H	H										H	
CO2					H				M				H	
CO3	M		H								M		H	M
CO4			H										H	M
CO5			H	H			M						H	H

   Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Design and development skills taught in this course for the learners with respect to the course outcomes are measurable. The learner can able to emphasize the importance of data structures in developing and implementing efficient algorithms.

CAD 6125
SDG: 9

OBJECT ORIENTED SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

COB1: Provide basic concepts of software engineering and software life cycle models.

COB2: Explore the techniques for requirement gathering design and specification.

COB3: Give an insight into the concepts of modeling and notations of the different UML diagrams.

COB4: Explain the strategies behind designing a project and track progress.

COB5: Provide knowledge on software configuration management.

MODULE I   INTRODUCTION TO SOFTWARE ENGINEERING   9

Software engineering concepts - Software engineering development activities - Software life cycle models- Standards for developing life cycle models- Modeling with UML.

MODULE II   REQUIREMENT, PLANNING & SCHEDULING   9

Introduction - Overview of requirements elicitation - Requirement elicitation concepts - Requirement elicitation activities - Managing requirement elicitation - Software Requirements Specification - Software project planning – Scope - Resources - Software Estimation - Empirical Estimation Models – Planning – Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

MODULE III   ANALYSIS   9

UML: Analysis Modelling - Data Modelling - Functional Modelling & Information Flow - Behavioural Modelling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model. Design modelling with UML.

MODULE IV   OBJECT ORIENTED DESIGN AND INTERFACE   9

Overview of object oriented design-Design Concepts& Principles-Design Process Modular Design - Design Effective Modularity - Reuse concepts- Reuse Activities Managing reuse-Overview of interface specification-Interface

specification concepts- Interface specification activities- Managing object design.

MODULE V   MPLEMENTATION   AND   TESTING 9 SOFTWARECONFIGURATION MANAGEMENT

Overview of mapping- Mapping models to Code- Mapping Object Model to Database Schema- Overview of testing- Testing concepts- Testing activities - Managing testing. Managing and controlling Changes- Managing and controlling versions- Types of maintenance- Maintenance log and defect reports- Reverse and re-engineering.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", McGraw Hill, seventh Edition, 2015
2. Ian Sommerville, "Software Engineering", Pearson Education, eighth edition, New Delhi, 2011.

REFERENCES:

1. Timothy C. Lethbridge, Robert Laganiere, "Object-Oriented Software Engineering - A practical software development using UML and Java", Tata McGraw-Hill, 3rd Edition, 2006.
2. S.K.Kataria, Rajiv Chopra, "Object Oriented Software Engineering", 3rd Edition,2013.
3. Stephan R. Schach, "Object oriented and classical software engineering", Tata McGraw Hill, 8th Edition, 2010.
4. Bernd Bruegge, "Object oriented software engineering", 3rd Edition, Pearson Education, 2009.

COURSE OUTCOMES:

CO1: Compare the different software life cycle models and select the appropriate model for a real time project

CO2: Identify the software requirement specification and formulate project planning in real time scenario.

CO3: Analyze different UML concepts and illustrate the UML design for real-time project.

CO4: Execute the object-oriented and software reusability concepts.

CO5: Implement and test software configuration management techniques in software engineering environment.

Board of Studies (BoS) :   **Academic Council:**

14th BoS of CA held on 06.06.2020   15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	H					M			L			H	
CO2			H						M					M
CO3			H				M		M				M	H
CO4	M				M	M					L		M	M
CO5		H	M	H	M			L				M	M	H

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Object Oriented Software Engineering concepts taught in this course for the learners with respect to the course outcomes are measurable Helps the learner to apply standard Software Engineering practices and strategies in real-time software project development. As a future industrial management personnel, the learner would be able to work in teams to build software systems, comprehend and write effective reports and design documentation.

CAD 6126   **DATA STRUCTURES ALGORITHMS**   L   T   P   C

USING C/C++ LABORATORY   0   0   2   1

SDG: 9
COURSE OBJECTIVES:

    COB1: Explain various sorting and searching algorithms.

    COB2: Explore linear and non-linear data structures

    COB3: Design and implement algorithms for searching and sorting

    COB4: Design and implement operations on stacks, queues, and linked lists

    COB5: Introduce the Binary Search Tree implementation using.

PRACTICALS

List of Experiments:

1. Write a C program to create a Stack and do the following operations using arrays and linked lists (i) Push (ii)Pop

2. Create a Queue and do the following operations using arrays and linked lists
   i) Add (ii) Remove

3. Write a C program to implement doubly linked list

4. Write a C program to sort a list of N elements of integer type using quick sort Algorithm

5. Write a C program to sort a list of N elements using Bubble sort Technique

6. Write a C program to search for an element in an array using Binary search

7. Write a C++ program to implement insertion sort method to sort a given list of integers in descending order.

8. Write a C++ program to implement selection sort method to sort a given list of integers in descending order.

9. Write a C++ program to Create a binary search tree and do the following traversals
   i) In-order (ii) Pre order (iii) Post order.

10. Perform the following operations in a given graph (i)Depth first search (ii) Breadth first search

11. Find the shortest path in a given graph using Dijkstra algorithm.

12. Apply the divide and Conquer technique to arrange a set of numbers

13. Construct optimal binary search trees using dynamic programming

method of problem solving.

14. Implement knapsack problem using backtracking
15. Find the solution of traveling salesperson problem using branch and bound Technique.

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. Tanenbaum A.S, Langram Y, Augestein M.J, "Data Structures using C" Pearson Education, 2004.
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill, 1st edition,July 2017.

REFERENCES:

1. Robert Kruse, Data Structures and program designing using 'C', 3rd edition,
2. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006.

COURSE OUTCOMES:

CO1: Apply various data structure such as stacks, queues, trees , linked list and graphs to solve various computing problems.

CO2: Choose and implement efficient data structures and apply them to solve problems.

CO3: Implement and analyze various searching techniques and sorting techniques.

CO4: Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs.

CO5: Develop program that implements kruskal's algorithm, prims, binary search, all types of sorting, greedy algorithm and backtracking technique.

Board of Studies (BoS) :   **Academic Council:**

14th BoS of CA held on 06.06.2020   15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		H	H										H	
CO2					H				M				H	M
CO3	M		H								M		H	
CO4			H										H	
CO5			H	H			M						H	

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Design and development skills taught in this course for the learners with respect to the course outcomes are measurable. The learner can able to emphasize the importance of data structures in developing and implementing efficient algorithms.

CAD 6127   **PROGRAMMING IN C AND C++**   L T P C

SDG: 9   **LABORATORY**   0 0 2 1

COURSE OBJECTIVES:

COB1: Describe the basic concepts of C structure.

COB2: Provide knowledge on functions, pointers, structures, and strings

COB3: Explain the necessity of Object-Oriented Programming over Traditional programming.

COB4: Illustrate concepts of Object-Oriented programming language

COB5: Demonstrate the use of file programming.

PRACTICALS

List of Experiments:

C programs

1. Programs using, I/O statements and expressions.
2. Programs using decision-making constructs.
3. Programs using looping statements (also demonstrate the use of break and continue statements).
4. Programs using single dimensional and multi-dimensional arrays.
5. Programs using string handling functions.
6. Programs using functions and recursive functions.
7. Demonstrate the use of structure and Union.
8. Demonstrate the use of Pointers.
9. Demonstrate the use of file handling.

C++ Programs

1. Simple Programs using Data Types, Input/output statements and Arithmetic Operators, Conditional statements and different loops.
2. Programs using structures and functions.
3. Programs using classes, objects and scope resolution operator.
4. Programs using Constructors and destructors.
5. Demonstration of array of object.
6. Demonstration using this->pointer.
7. Application Programs using Simple, Multiple, Multilevel, Hierarchical and Hybrid Inheritance.
8. Demonstration of Virtual function, Friend function and Static function.

9. Programs to implement function overloading.
10. Programs using operator overloading for Binary, Unary and relational operators.
11. Demonstration of pointers to base class and derived class member functions.
12. Programs using Function and Class template.
13. Program to access a record using file handling.

P – 30; TOTAL HOURS – 30

TEXT BOOKS:
1. Yashavant P. Kanetkar, "Let Us C", BPB Publications; Seventeenth edition, September 2020.
2. Kunal Pimparkhede, "Computer Programming with C++", Cambridge University Press; First edition, January 2017.

REFERENCES:
1. G Balagurusamy, "Object-Oriented Programming with C++ | 8th Edition",McGraw Hill; Eighth edition (24 September 2020); McGraw Hill Education (India) Private Limited, September 2020.
2. Yashavant Kanetkar, "Let Us C++", BPB Publications,16 September 2020.
3. Herbert Schildt, "C++: The Complete Reference, 4th Edition", McGraw Hill Education; 4th edition, July 2017.
4. Stanley Lippman, "C++ Primer", Addison-Wesley; 5th edition, August 2012.

COURSE OUTCOMES:
CO1: Develop C programs for simple applications making use of basic constructs, arrays, strings.
CO2: Develop C programs involving functions, recursion, pointers, and structures.
CO3: Develop C++ programs using Class, Objects, array of object, function overloading, operator overloading.
CO4: Develop C++ programs using the concepts of Object-Oriented Programming features.
CO5: Design applications using sequential and random-access file processing.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M	L											
CO2	M	H							L					
CO3			L										H	M
CO4	H					L				M				
CO5				L									M	H

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 9: Develop durable Infrastructure, promote inclusive and balanced industrialization and adoptive innovation.

Strategy and development skills taught in this course for the beginners with respect to the course effects are measurable and useful in improving the ability of the learner. As the future industrial management staffs, the learner would make choices with the help of computational intelligence-based assessment support systems.

CAD 6128	**DBMS LABORATORY**	**L**	**T**	**P**	**C**
SDG: 4		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: Learn how to create tables which are fundamental storage blocks of data.

COB2: Learn how to place constraints on data that is entered on tables to ensure data integrity.

COB3: Learn how to add, change and remove data from tables.

COB4: Learn how to select a subset of the data you want to see from the collection of tables and data.

COB5: Learn how to combine table and group multiple rows of data in table.

PRACTICALS
List of Experiments:

1. Execute a single line and group functions for actable.
   - UPPER function converts a string to upper case.
   - LOWER function converts a string to lower case.
   - MONTHS_BETWEEN function returns the count of months between the two dates.
   - NEXT_DAY function returns the next day of the date specified.
   - LAST_DAY function returns last day of the month of the input date.
2. Execute DCL and TCL Commands.
   - GRANT-REVOKE-
   - COMMIT–ROLLBACK–SAVEPOINT-SET TRANSACTION.
3. Create and manipulate various DB objects for a table.
   - Table – This object is used to create a table in database.
   - This object is used to create a view in database.
4. Create views, partitions and locks for a particular DB.
5. Write PL/SQL procedure for an application using exception handling.
6. Write PL/SQL procedure for an application using cursors.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write a PL/SQL block for transaction operations of a typical application using triggers.

9. Write a PL/SQL block for transaction operations of a typical application using package.

10. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD)

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Data Base System Concepts", McGraw- Hill, 6th Edition, 2011 .

2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson,7th Edition,©2016 .

REFERENCES:

1. Raghu Ramakrishnan & Johannes Gerhrke, "Data Base Management Systems", McGraw Hill International 3rd Edition, 2014.

2. An Introduction to Database systems, C.J. Date, A. Kannan, S. SwamiNadhan, Pearson, Eight Edition,2016.

COURSE OUTCOMES:

CO1: Apply iterative programming at database level

CO2: Write programming blocks with conditional structure, assignment structure, loop structure et

CO3: Use exception Handling, Transaction oriented programs, Stored procedures, functions, packages, etc

CO4: Implement cursors which would allow row wise access of data

CO5: Use triggers which would allow you define pre and post actions when something change in the database tables

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	L												H
CO2	M	M												H
CO3					M	L								H
CO4					M					M				H
CO5			H		H			M						H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Database related programming plans, concepts, & features are taught in this course for the learners with respect to the course outcomes are measurable and useful in improving the query based programming and logical skill of the learner. As the software industries growing rapidly, this course will enable the learner to explore various technologies such as Oracle MySQl, Microsoft SQL Server, DB2, MongoDB, and NoSQL.

SEMESTER II

CAD 6221	**PROGRAMMING IN JAVA**	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Provide basic understanding of Java fundamentals

COB2: Explore inheritance, interfaces and packages.

COB3: Explain Java programs to perform multi-threading and exception Handling

COB4: Familiarize the programming skills to use the object-oriented programming methodology to produce quality computer based solutions to real time problems.

COB5: Introduce collection of AWT packages and develop programs.

MODULE I   JAVA FUNDAMENTALS   9

Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Arrays –Constructor.

MODULE II   INHERITANCE AND INTERFACES   9

The Java Class- Inheritance, Derived Classes, Method Over-riding, Method Overloading, Access Modifiers, Abstract Class and Method, Interfaces, Packages, Imports and Class Path.

MODULE III   THREADING AND EXCEPTION HANDLING   9

Threads: Introduction, Creating Threads in Applications-Thread Priority-Exception Handling- Try- Catch Statement, catching more than one Exception, Generating Exceptions.

MODULE IV   APPLETS AND AWT PACKAGES   9

Create an Applet, Applets Life Cycle, and AWT package – Layouts – Containers – Event Package – Event Model – Painting– Language Packages.

MODULE V   STREAM CLASSES AND I/OPACKAGES   9

Input Stream Classes, Output Stream Classes, File Class. Utility Packages – Input Output Packages – Inner Classes – Java Database Connectivity - Servlets - RMI –Java Beans.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Herbert Schildt, "Java The Complete Reference ", Tata McGraw Hill, 11th Edition, 2020.
2. Hortsmann & Cornell, "Core Java Advance Features VOL II", Pearson Education, 9th Edition, 2013.

REFERENCES:

1. Keyur shah, "Gateway to Java Programmer Sun Certification", TataMcGraw Hill , 2005.
2. Deitel &Deitel, Java How to Program, Prentice Hall 11th Edition 2018.

COURSE OUTCOMES:

CO1: Write java programs using control structures, arrays and constructors.
CO2: Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
CO3: Compare and contrast the interfaces and abstract classes
CO4: Handle the exceptions effectively and illustrate the life cycle of thread.
CO5: Create solutions for real time problems using AWT packages, servlets and java beans.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			H										M	
CO2	M													L
CO3			H					L	M					H
CO4			M					L	H					H
CO5			H						H					M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable Industrialization and foster innovation

By understanding the object-oriented features of Java, the students will be able to apply the knowledge to derive solutions to computing problems. Apply object-oriented principles in software design process, the students will be able to analyze complex problems in the domain of software development with better effectiveness. Java programming helps in finding solutions to the real time applications.

CAD 6222	RESOURCE MANAGEMENT	L	T	P	C
SDG: 9	TECHNIQUES	3	1	0	4

COURSE OBJECTIVES:

COB1: Explain mathematical model of linear programming problems.

COB2: Illustrate mathematical model of Transportation problems.

COB3: Familiarize the mathematical model of Assignment problems.

COB4: Explore network modeling for planning and scheduling the project activities.

COB5: Demonstrate Queuing Models to minimize waiting time in the queue.

MODULE I   LINEAR PROGRAMMING MODELS   12

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques-Variants.

MODULE II   TRANSPORTATION AND ASSIGNMENT MODELS   12

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – Optimum solution - Degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.

MODULE III   INTEGER PROGRAMMING MODELS   12

Formulation – Gomory's IPP method – Gomory's mixed integer method – Branch and bound technique.

MODULE IV   PROJECT SCHEDULING BY PERT AND CPM   12

Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.

MODULE V   QUEUING MODELS   12

Characteristics of Queuing Models–Poisson Queues-(M/M/1):(FIFO/∞/∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO/N / 8) models.

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Taha H.A., University of Arkansas "Operations Research: An Introduction, global edition, Pearson Education, 10th Edition, 2017.

REFERENCES:

1. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.
2. Gross, D. and Harris, C.M., "Fundamentals of Queueing Theory", Wiley Student, New Jersy, 3rd Edition 2012.
3. N. D Vohra, Quantitative Techniques in Management, Tata Mcgraw Hill, 2010.

COURSE OUTCOMES:

CO1: Formulate and apply linear, integer programming to solve operational problems taking into accounts of social and economic constraints with ethical values.

CO2: Solve transportation and assignment models to find optimal solution in warehousing, travelling problems in industries like automobile.

CO3: Prepare project scheduling using PERT and CPM.

CO4: Identify and analyze appropriate queuing model to reduce the waiting time in queue.

CO5: Solve optimization concepts in real world problems.

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CO1	H	H		M		H		M			L	L		
CO2	H	H	L		M						M			L
CO3		M		M			L		H	H				
CO4		H	L	M							L		L	
CO5		M	H	L			M					M	M	

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

The learner will be able to identify the problem of concern; then, build a quantitative mathematical model, analyse and solve it, apply the results, and potentially create appropriate mathematical software that can be commercialized.

CAD 6223   **CLOUD COMPUTING**   **L   T   P   C**

SDG: 4   **3   0   0   3**

COURSE OBJECTIVES:

    COB1: Explain the basic concept of cloud computing.

    COB2: Explore about various cloud services provided by different service providers.

    COB3: Illustrate the virtualization concepts in cloud environment.

    COB4: Expose various ways to deploy the cloud services in online.

    COB5: Learn about the different online tools available in the cloud environment.

MODULE I   **INTRODUCTION**   **9**

Introduction to Cloud Computing: Cloud Computing in a Nutshell – Roots of Cloud Computing – Layers and Types of Cloud Computing – Cloud Infrastructure Management – Migration to Cloud Environment: Approaches – The Seven Step Model for Migration.

MODULE II   **CLOUD EVOLUTION AND SERVICES**   **9**

Evolution of Cloud Computing: Hardware Evolution – Internet Software Evolution – Server Virtualization – Web Services Delivered from the Cloud: Communication as a Service (CaaS) – Infrastructure as a Service (IaaS) – Platform as a Service (PaaS) – Software as a Service (SaaS) - Cloud Deployment Models : private – public – hybrid – Discovering Cloud Services DevelopmentServicesandTools–AmazonEc2–GoogleAppEngine–IBM Clouds.

MODULE III   **VIRTUALIZATION**   **9**

Level of Virtualization – Virtualization Structure / Tools and Mechanism – Virtualization of CPU – Memory – I / O Devices – Virtual Clusters and Resource Management – Virtualization for Data Centre Automation.

MODULE IV   **APPLICATIONS USING CLOUDSERVICES**   **9**

Application - Calendars, Schedules and Task Management – Exploring Online Scheduling - Applications – Exploring Online Planning and Task Management – Event Management – Contact Management– Project Management –Databases – Storing and Sharing Files.

MODULE V   **COLLABORATION**   **9**

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis – Case Study.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles Books and Paradigms, Wiley, 2010
2. Rittinghouse, John W.,and James F. Ransome, "Cloud Computing: Implementation, Management and Securityǁ,"CRC Press, 2017.

REFERENCES:

1. Kumar Saurabh, "Cloud Computing – Insights into New Era Infrastructure", Wiley Indian Edition, 2011.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On- demand Computing, Applications and Data Centres in the Cloud with SLAs, Emereo Pty Limited, July 2008.
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", MorganKaufmann Publishers, 2012.
4. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

COURSE OUTCOMES:

CO1: Acquire knowledge on the fundamentals of cloud computing.

CO2: Identify and implement the architecture and various services offered by cloud computing.

CO3: Analyze and implement on different types software's used in virtualization environment.

CO4: Apply the knowledge acquired to integrate the cloud based technologies in real time scenario.

CO5: Explore and implement the insights of online cloud based tools in developing software project applications.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L		M										H	
CO2		H			H								H	
CO3			M		M								M	
CO4			M		H				H				H	
CO5									M		M		H	H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The basics of cloud computing and its techniques were taught in this course. Understanding the insights of cloud computing and virtualization will motivate the student to deploy cloud technology in needed real-time scenarios. The applications of cloud computing will improve the skill set of the student to meet the IT sector demand.

CAD 6224	MOBILE APPLICATION	L	T	P	C
SDG: 9	DEVELOPMENT	3	0	0	3

COURSE OBJECTIVES:

COB1: Give an overview on different mobile development environment.

COB2: Gain basic understanding of Android application development.

COB3: Impart knowledge on how to build an Android application

COB4: Understand the IOS development environment

COB5: Provide knowledge on how to build an iOS application

**MODULE I   INTRODUCTION TO MOBILE APPLICATION   9
                DEVELOPMENT**

Introduction to mobile applications-Differences between mobile applications and desktop applications-App store, Google Play, Windows Store-Hybrid Mobile App Development-Phone GAP-Ionic Framework.

MODULE II   ANDROID FRAMEWORK   9

Introduction to Android-Brief history-Features of Android-The Android Platform - Android SDK - Anatomy of an Android Application-Creating Android Virtual Devices-Manifest file - Activity - Services-Content Provider-Broadcast Receiver-Intents - SQLite Databases.

MODULE III   USER INTERFACE DESIGN   9

Android User Interface Design Elements-Views: Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner -View Groups-Android Layout Managers-- List View- Grid View-Table View- Web View- Adapters-Menus, Action Bars, Notifications: Status, Toasts and Dialogs, Styles Themes-Drawing and Working with Animation Android Media API: Playing audio/video, Media recording. Sensors - Maps & Location.

MODULE IV   IOS DEVELOPMENT FUNDAMENTALS   9

iOS Basics - iOS Architecture - Integrated development Tools – Introduction to XCode, Swift - Frame work and Libraries - Project templates - Resource & Application Settings - Views & Controls - Debugging & Running - Building Block Approach - Application Life cycle - MVC – Pattern – View.

MODULE V   ADVANCED CONCEPTS IN IOS   9

Data Management - Core Data - Application Storage - External Storage -

Memory Management - Leaks and Allocations - UI Design - Design Tools - Interface Builders - Story board - View Controllers - Drawing model – Windows - Event Handling - View data Source and delegates - Multimedia and Networks - Library - Location Services - Google Maps - Apple Push and Local Notifications - Accelerometer.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Dawn Griffiths &David Griffiehts, Head First Android Development, O'Reilly Publication, Second Edition,2017.
2. Ahmad Sahar, Programming for Beginners, IOS 13, Packt Publishing, Fourth Edition, 2020.

REFERENCES:

1. Reto Meier, Professional Android 4 Application Development, Wrox Publications, Third Edition,2012.
2. David Mark, Jack Nutting, Jeff Lamarche and Frederic Olsson Beginning iOS 6 Development: Exploring the iOS SDK, Apress, 2013.

COURSE OUTCOMES:

CO1: Describe the requirements for mobile applications

CO2: Explain the architecture and building blocks of Android

CO3: Develop and design mobile applications using Android for specific requirements

CO4: Explain the architecture and building blocks of iOS

CO5 :Develop and design mobile applications using iOS for specific requirements

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			M		L								L	
CO2			M		L									
CO3			M						M					M
CO4			H		M									
CO5			M						M					M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

The skills taught in this course for the learners with respect to the course outcomes are measurable and useful in improving the programming skill of the learner. By learning this subject, the learner can develop innovative mobile applications which can solve several problems of the user.

CAD 6225	INTRODUCTION TO DATA SCIENCE	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: Explain fundamentals of data science and statistical modeling techniques.

COB2: Describe proficiency with statistical analysis of data.

COB3: Demonstrate on mathematical tools for data science.

COB4: Familiarize on machine learning algorithms for predictive modeling.

COB5: Expose to different data visualization tools and techniques.

MODULE I   **INTRODUCTION**   **9**

Introduction: Data Science - Big Data and Data Science hype –Datafication - Current landscape of perspectives - Skill sets needed. Statistical Inference - Populations and samples - Statistical modelling, probability distributions, fitting a model.

MODULE II   **EXPLORATOTY DATA ANALYSIS**   **9**

Exploratory Data Analysis - Getting and Cleaning data Statistical Inferences - Summarizing and Visualizing the Data

MODULE III   **MATHS FOR DATA SCIENCE**   **9**

Mathematical Tools for Data Science - Statistics Inferences and Probability - Linear Algebra

MODULE IV   **MACHINE LEARNING**   **9**

Machine Learning in Data Science Supervised, unsupervised, reinforcement and deep learning, Naive Bayesian Algorithm, K means, K nearest Neighborhood algorithms.

MODULE V   **DATA VISUALIZATION**   **9**

Data Visualization - Basic principles, ideas and tools for data visualization. Examples of inspiring (industry) projects. Creation of own visualization of a complex dataset. Data Science and Ethical Issues - Discussions on privacy, security, ethics.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

REFERENCES:
1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
2. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)

COURSE OUTCOMES:

CO1: Describe the Data Science Process and how its components interact.

CO2: Explain the significance of exploratory data analysis (EDA) in data science.

CO3: Apply basic tools (plots, graphs, summary statistics) to carry out EDA.

CO4: Analyze the different basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes) for predictive modeling.

CO5: Create effective visualization of given data (to communicate or persuade).

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CO1	M	H												
CO2		M								H				
CO3	H			M										
CO4	M	H		M					L	H				
CO5								M		H				

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Complete understanding of the Data Science process applying the various machine learning algorithms and deriving comparative study with exposure to EDA tools.

| CAD 6226 | COMMUNICATION SKILLS | L | T | P | C |
| SDG: 4 | LABORATORY | 0 | 0 | 2 | 1 |

COURSE OBJECTIVES:

COB1: To enhance the ability of students in Learning, Speaking, Reading, Writing (LSRW) skills.

COB2: To develop their speaking skills to interact efficiently in real life situations and in workplace

COB3: To impart listening and reading techniques for better communication

COB4: To improve the writing skills of students through reports, letterset.

MODULE I   FUNDAMENTALS OF LANGUAGE   3

Tenses, Subject – Verb Agreement, Correction of Errors.

MODULE II   ORAL COMMUNICATION   15

Introducing oneself, Conversations, Role-play - Activities based on real life situations and professional situations such as marketing, advertising, etc. Debating on a topic, Group Discussion, Oral Presentation, Non-verbal communication, Mock Interviews, Phonetics- Correct Pronunciation.

MODULE III   WRITTEN COMMUNICATION   6

Writing a letter of application with résumé - calling for quotations – placing an order – letter of complaint, Memoranda, Writing an email, Report Writing - Project report.

MODULE IV   LISTENING AND READING   6

Language fundamental practices - Listening Comprehension, Reading Comprehension, Listening to correct pronunciation, Accent, Viewing models of Presentations, Interviews.

P – 30; TOTAL HOURS – 30

REFERENCES:

1. "A Textbook of English and communication skills" by Richa Mishra, Ratna Rao1 January 2019.
2. Andrea J. Rutherford, "Basic Communication Skills for Technology", second edition, Pearson Education, 2007.
3. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, "A Course in Communication Skills", Cambridge University Press, India 2007.

4. Krishna Mohan and Meera Banerjee, "Developing Communication Skills", Macmillan India Ltd. (reprinted 2007).
5. Riordan, Pauley, "Report Writing Today", AIT B.S. Publisher, New Delhi (2000).

COURSE OUTCOMES:

CO1: Demonstrate the efficacy of their reading and listening skills.

CO2: Speak fluently on various topics and participate effectively in debates and discussions.

CO3: Write professional documents like reports, letters and proposals efficiently.

CO4: Communicate clearly using appropriate vocabulary and grammatically correct expressions.

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CO1								M		H				
CO2									H	H				
CO3										H				
CO4										M				

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 4: Quality Education: - Building a Communication Skills for Discussion on various sectors as an Industrialist, Corporate works, and Academician.

Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others. Such skills could include communication competencies such as managing conflict, understanding small group processes, active listening, appropriate self-disclosure.

CAD 6227
SDG: 9

**ADVANCED TECHNOLOGY
LABORATORY
(Cloud/Mobile/Data Science)**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

COB1: Explain the fundamental concepts of cloud computing.

COB2: Explore the services and security concepts in cloud environment

COB3: Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.

COB4: Demonstrate the basic concepts of Reprogramming

COB5: Illustrate Data Science applications using Reprogramming

PRACTICALS
LIST OF EXPERIMENTS:
CLOUD COMPUTING:

1. Create NFS & VMFS Data store in the v-Sphere Web Client.
2. Implementation of Load Balancing in AWS.
3. Manage Hosts on a v-Sphere Distributed Switch in the v-Sphere Web Client.
4. Study and implementation of Infrastructure as eservice.
5. Study and implementation of Storage as a Service.
6. Study and implementation of Cloud Security management.

MOBILE APPLICATION DEVELOPMENT:

1. Develop an application that uses GUI components, Fonts and colors.
2. Develop an application that uses layout managers and event listeners.
3. Develop a native calculator application.
4. Develop an application that draws basic graphical primitives on the screen.
5. Develop an application that creates an alarm clock.

DATA SCIENCE USING R PROGRAMMING:

1. Programs using basic data types
2. Programs using Arrays.
3. Programs using Matrix.

4. Programs using Vector
5. Programs using Functions.
6. Programs using Data frame.
7. Programs using List and Factors.
8. Programs using loops.
9. Programs using Plots and tabulation.

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. Ritting house, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
2. IOS 13 Programming for Beginners-Fourth Edition, Ahmad Sahar, Packt Publisheing-2020
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk fromthe Frontline. O'Reilly. 2014.

REFERENCES:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Dawn Griffiths &David Griffiehts, Head First Android Development – Second Edition,2017-O'Reilly Publication
3. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

COURSE OUTCOMES:

CO1: Implement the cloud services in real-time scenario.
CO2: Deploy cloud-computing technologies to analyze the security management in real time projects.
CO3: Develop and deploy mobile applications for the Android operating system using basic and advanced phone features.
CO4: Implement basic R programming concepts.
CO5: Analyze and plot graph for various data science applications.

Board of Studies (BoS) :
14th BoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1													H	
CO2				L									H	
CO3								M					H	M
CO4	L													
CO5													H	

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The clear understanding of cloud, data science and mobile app development, leads to new innovations and build better technology leading to sustainable industrialization

| CAD 6228 | **PROGRAMMING IN JAVA** | L | T | P | C |
| SDG: 09 | **LABORATORY** | 0 | 0 | 2 | 1 |

COURSE OBJECTIVES:

COB1: Explain object-oriented programming techniques.

COB2: Provide quality-based software solutions to real problems.

COB3: Familiarize the advance features of java technology.

COB4: Demonstrate the use of application programming interface (api) and develop programs.

COB5: Illustrate multithreaded programs with exception handling mechanism.

PRACTICALS

List of Experiments:

1. Program to implement various looping structures and arrays.
2. Program to illustrate the use of overloading and overriding.
3. Program to implement the concept of inheritance.
4. Program to illustrate the use of multi-threading.
5. Program to implement the concept of Interfaces and packages.
6. Generate the program using exceptions handling mechanism.
7. Implement the file operations.
8. Implement i/o stream classes
9. Program using Applets.
10. Program to handle Mouse Events, Keyboard Events and work with GUI Components.
11. Program using JDBC.

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. Herbert Schildt, The Complete Reference – Java 2, 7thEdition, Tata McGraw Hill, 2017.

REFERENCES:

1. Deitel & Deitel, Java How to Program, Prentice Hall 9TH Edition 2011.

COURSE OUTCOMES:

CO1: Apply basic control structures, arrays, looping statement and various class libraries in developing program.

CO2: Write java programs using object-oriented programming techniques inheritance, polymorphism, interface, constructors and abstract class.

CO3: Create package for real time applications like bank transaction, employee processing etc.

CO4: Construct multithreaded programs and handle exceptions.

CO5: Develop programs using Applets.

Board of Studies (BoS) :   **Academic Council:**

14th BoS of CA held on 06.06.2020   15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H										M		M	
CO2		H		M									H	
CO3			M		H								H	
CO4				L	M									L
CO5	H										M			M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Helps in Learning the basic programming concepts. It helps in increasing the student's skill and helps them to get placed.

SEMSTER III

CAD 7121	**PYTHON PROGRAMMING**	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: Apply various data types and control structures.

COB2: Facilitate code reusability and explore object-oriented features.

COB3: Learn how to use indexing and slicing to access data.

COB4: Manipulate and preprocess the data using Pandas.

COB5: Visualize the data in a graph, chart or other visual format.

MODULE I   FUNDAMENTALS OF PYTHON   9

Features of Python – Data types: Numbers, Strings & its operations, Boolean – Operators – List & its operations, Tuples & its operations, Dictionaries & its operations – Arrays – Input and Output – Conditions statements: if, if-else, if-elif-else – Looping statements: while, for

MODULE II   MODULARIZATION AND OOPs CONCEPT   9

Functions: With and without argument, with and without return, recursive function, Date function, Math function, Lambda – Error handling – Classes and Objects – Inheritance – Polymorphism – Exception Handling.

MODULE III   INTRODUCTION TO NUMPY   9

NumPy array attributes – Array indexing – Array slicing – Computation on Numpy Arrays – Aggregations – Sorting arrays.

MODULE IV   FILE HANDLING & DATA MANIPULATION USING   9
PANDAS

File Handling: Files I/O - Printing to the Screen - Reading Keyboard Input - Opening and Closing Files - Reading and Writing Files - Renaming and Deleting Files - Directories in Python – Exceptions - Except Clause.

Data Manipulation using Pandas: Introduction to Jupyter – Pandas Basics (DataFrame), Pandas Series and Index Objects – Position / Label based data indexing and selection.

MODULE V   DATA PREPROCESSING & VISUALIZATION   9

Data Work Flow & Importing Data – Data Cleaning: Handling of in consistent data – Detection of missing values – Removing & Replacing missing values –

Duplicate Data Handling – Detection of Outliers. General Matplotlib Tips – Customization of Plots – Line Plots – Histogram – Barcharts and Pie Charts – Scatter Plots.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:
1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning, 2nd 2018. (ISBN: 9781337560092)
2. Dusty Phillips, Python Object Oriented Programming, PACKT Press, 4th Edition, 2021. (ISBN: 9781801077262)
3. Jake VanderPlas, Python Data Science Handbook: Essential tools for working with data, O'Reilly Media, CA, 2016.

REFERENCES:
1. Mark Lutz, Programming Python, O'Reilly Media, 5th Edition, 2013.
2. Tony Gaddis, Starting Out with Python, Pearson, 5th Edition, 2021. (ISBN: 9780136679110)
3. Downey, Allen B, Think Python: How to Think Like a Computer Scientist, O'Reilly, 2nd Edition, 2016.
4. David M. Baezly, Python Cookbook, O'Reilly Media, 3rd Edition, 2013.

COURSE OUTCOMES:

CO1: Demonstrate the use of built-in data structures list, tuple and dictionary.

CO2: Implement object oriented concepts.

CO3: Process and analyze the data using NumPy.

CO4: Handle missing data and work with combining data sets using Pandas.

CO5: Understand the insight of the dataset using visualization.

Board of Studies (BoS) :
15th BoS of CA held on 22.06.2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M									H		M	
CO2	H	H	M	L										
CO3	H	H	H	H	H					M	M		H	H
CO4	H	H	H	H	H					M	M		H	H
CO5	H	H	H	H	H					M	M		H	H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The language constructs as well as its object-oriented approach aim to help students to write clear, logical code for small and large-scale projects. Students have a much higher chance of finding a solution to any problem. Python, is the go-to technology for scientific computing. Multiple Studies unequivocally hail Python as the most popular language for machine learning and data science.

CAD 7122   **BLOCKCHAIN TECHNOLOGIES**   L   T   P   C

SDG: 9   3   0   0   3

COURSE OBJECTIVES:

COB1: Learn the basic concepts of Block chain Technologies.

COB2: Impart knowledge about Block chain General Architecture.

COB3: Learn the inventory management concepts for optimizing supply chain performance.

COB4: Integrate block chain technologies with supply chains.

COB5: Apply the Block chain concepts in different use cases.

MODULE I   INTRODUCTION   9

Basics of blockchain, History, Uses of Blockchain, Structure of a block, Transactions, Public Ledger, blockchain working, accumulation of blocks, pros and cons of blockchain, tiers of block chain technology, features of blockchain. Types of blockchain: Distributed Ledger, Public Blockchains, Private Blockchains, Semiprivate Blockchains, Side chains, Permissioned Ledger, Shared Ledger, Fully Private and Proprietary Blockchains, Tokenized Blockchains, Token less Blockchains.

MODULE II   BLOCKCHAIN ARCHITECTURE   9

Design methodology for blockchain applications, blockchain application templates, blockchain application development, Ethereum, Solidity, Business problems. Decentralized applications-Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps.

MODULE III   MANAGING INVENTORY IN SUPPLY CHAIN   9

Definition, Concept, Significance and Functions of Operations and SCM. Value in Supply Chain- quality, delivery, flexibility, Source management in Supply Chain- in sourcing, outsourcing, Make Vs Buy , Managing Inventory in Supply chain- definition of inventories, Role of Inventory, Inventory control techniques (ABC Analysis, VED Analysis).

MODULE IV   BLOCKCHAIN INTEGRATION WITH SUPPLY CHAINS   9

Supply Chain Management & Blockchain Integration Overview, Supply Chain Management Traditional Architecture, Supply Chain Management Blockchain Architecture, Blockchain Deployment Stages, Use case - Food Industry Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyper ledger Fabric.

MODULE V   CASE STUDIES   9

Manufacturing and production, supply chain management, logistics and transportation, Internet of things, e-voting, healthcare, product life cycle, knowledge and innovation management, new business models and applications, Case studies: Decentralized fleet tracking system, supply chain and logistics, Real World Case Study (IBM/Wal-Mart and VeChain).

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Bahga A., Madisetti V.,Blockchain applications: a hands-on approach, VPT, 2017.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.

REFERENCES:

1. Vikram Dhillon, David Metcalf and Max Hooper, "Blockchain enabled Applications", A press, 2017,
2. B. Mahadevan, Operations Management Theory & Practice, Pearson, 3rd edition, 2015.

COURSE OUTCOMES:

CO1: Identify the stakeholders of the select supply chain for block chain integration.

CO2: Design the requirement engineering metrics for the system to integrate block chain technologies.

CO3: Select the appropriate commodity or specific product supply chain with start node and end node for the effective inventory movement.

CO4: Write the SMART contract using Hyper Ledger.

CO5: Evaluate and manage the supply chain with block chain integration.

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		M		H										
CO2			H											
CO3			H											
CO4						H								H
CO5				H						M				

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The cognitive learning objectives, socio-emotional learning objectives and behavioral learning objectives are achieved in the course outcomes as the learner would be able to select the commodity/product supply chain, identify the stakeholders and the explanatory variables of the system, evaluate the supply chain performance and optimize it innovatively with block chain integration.

CAD 7123   **BIG DATA ANALYTICS**   **L**   **T**   **P**   **C**

SDG: 9   **3**   **0**   **0**   **3**

COURSE OBJECTIVES:

COB1: Understand the fundamental concepts of big data and analytics.

COB2: Gain the knowledge about big data storage, processing, visualization, and application problems in real time world scenario.

COB3: To set up single and multi-node Hadoop Clusters.

COB4: To solve a big data problem using MapReduce technique.

COB5: Learn how to handle the large volume of data in cloud environment.

MODULE I   **INTRODUCTION**   **9**

Overview of Big Data and Its Importance - Source of Big Data - Four V's of Big Data - Types of the Data and Its Applications - Role of Distributed System in Big Data - Complexity of Data & Data Analysis - Big Data Use Cases - Data Model - Structures, Operations and Constraints - Data Discovery.

MODULE II   **BIG DATA ARCHITECTURE**   **9**

Introduction to Big Data Integration and Processing - Traditional Data Integration - Transforming Data for Processing - Data Fusion - Big Data Analytical Tools - In-Memory Computing Technology for Big Data – Predictive Analytics - Data Intelligence - Data Serialization - Data Monitoring & Indexing.

MODULE III   **HADOOP ECOSYSTEM**   **9**

Overview of Big Data Frameworks - Apache Hadoop - History and Milestone of Hadoop - Core Components of Hadoop - Hadoop Architecture - Hadoop Ecosystem - Distinguishing Hadoop Daemons and Its Features - Overview of HDFS - HDFS Architecture - MapReduce in Hadoop - Hadoop Single & Multi-Node Cluster – Overview of Apache Spark.

MODULE IV   **CLOUD SERVICES FOR BIG DATA STORAGE**   **9**

Overview of Big Data Storage - Data Storages in Cloud Environment – Cloud Based Storage Services – AWS & Microsoft Azure - Azure Data Lake Analytics - Azure Data Factory – AWS Big Data Storage & Collection Services - ETL Techniques - Traditional ETL – Benefits of ETL in Big Data Analytics.

MODULE V   CASE STUDY   9

Overview of Real Time Big Data Analytics - Real-Time Architecture - Characteristics of Real-Time System - Challenges of Real-Time System - Data Stream Analytics Platforms - Big Data Analytic Applications - Social-Media, Health-Care, Agriculture, Education Sectors & E-Commerce.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, AmbigaDhiraj, Wiely CIO Series, 2013.
2. Dietrich, D. Data science and big data analytics: discovering, analyzing, visualizing and presenting data. John Wiley & Sons, 2015.
3. Buyya Rajkumar, Rodrigo N. Calheiros, and Amir Vahid Dastjerdi. "Big data: principles and paradigms". Morgan Kaufmann, 2016.

REFERENCES:

1. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
3. M. Bernard. Big data in practice: how 45 successful companies used big data analytics to deliver extraordinary results. John Wiley & Sons, 2016.

COURSE OUTCOMES:

CO1: In-depth understanding of the concepts and intricacies of big data analytics

CO2: Categorize and Summarize Big Data and its importance

CO3: Learn NoSQL databases and management system

CO4: Understand the data storage in cloud environment like Microsoft Azure & AWS

CO5: Gain knowledge about real world applications of big data analytics.

Board of Studies (BoS) :   **Academic Council:**
15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L									L				L
CO2	H		L						M			H		H
CO3				H				L	M				H	
CO4	L									M	L	M		L
CO5				M								H		

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation & Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Designing and developing skills taught in this course with respect to the course outcomes improve the analytical knowledge and innovation of the learner. It would create a variety of ways for the learner to progress and can help significantly improve the quality of the learner.

CAD 7124   **MACHINE LEARNING TECHNIQUES**   L   T   P   C

SDG: 4   3   0   0   3

COURSE OBJECTIVES:

    COB1: Understand the basic concepts of Machine learning

    COB2: Apply Supervised Machine Learning Techniques for data handling.

    COB3: Understand the features of Neural network and its applications

    COB4: Create Unsupervised Learning models for handling unknown patterns

    COB5: Learn the concepts of Advanced and Reinforcement Learning

MODULE I   **INTRODUCTION TO MACHINE LEARNING**   9

Introduction to Machine learning - Machine Learning types- Types of data - Exploring structure of data - Data quality and Remediation - Data Pre-processing – Model Selection - Training and testing the Model – Model representation. Introduction to Feature Engineering: Feature Transformation & Subset Selection. Overview of Probability: Discrete – Continuous – Probability distribution.

MODULE II   **SUPERVISED LEARNING**   9

Classification: Classification and Regression Trees (CART) - K-Nearest Neighbors - Support vector machines. Bayes theorem - Naïve Bayes - Bayesian belief network. Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

MODULE III   **NEURAL NETWORK LEARNING**   9

Multilayer perceptron: Introduction - Perceptron - Training - Backpropagation algorithm -Training procedures - Tuning the network size; Competitive learning: Adaptive resonance theory - Self-Organizing maps, Radial Basis Functions - Learning Vector Quantization - Hebbian Learning, Application of Neural network – Face recognition.

MODULE IV   **UNSUPERVISED LEARNING**   9

Introduction to Clustering - Partitioning method: K-means - K-medoids; Hierarchical Clustering - Spectral Clustering, Association Rule Learning - Apriori algorithm - Expectation Maximization - Dimensionality reduction - Principal components analysis (PCA).

MODULE V   **ADVANCED LEARNING**   9

Reinforcement Learning – Representation Learning - Active Learning - Ensemble

Learning - Random Forest - Bootstrap Aggregation - Boosting - Gradient Boosting Machines – Deep learning.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
2. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson, 4th impression, 2019, Pearson Publications.
3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
4. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.

REFERENCES:

1. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.
2. Jiawei Han and Micheline Kambers and Jian Pei, "Data Mining –Concepts and Techniques", 3rd edition, Morgan Kaufman Publications, 2012.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2008.

COURSE OUTCOMES:

CO1: Identify and apply the appropriate techniques to process the data and solve the applications using machine learning techniques

CO2: Gain in-depth familiarity with various supervised learning algorithms

CO3: Implement machine learning through Neural networks.

CO4: Apply the Unsupervised learning techniques in real life problems.

CO5: Develop skills by using advanced machine learning techniques for solving practical problems.

Board of Studies (BoS):
15th BoS of CA held on 22.06.2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H												
CO2	H	H	M	M									H	H
CO3	H	H	M	M									H	H
CO4	H	H	M	M									H	H
CO5	H	H	M	M									H	H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Course Outcomes have achieved the Curricula need and Learner would acquire complex problem solving skills with critical thinking ability. The learner will able to use all opportunities and to apply the acquired knowledge in everyday situations to promote sustainable development

CAD 7125	ADVANCED WEB DEVELOPMENT	L	T	P	C
SDG: 9	AND SERVICES	3	0	0	3

COURSE OBJECTIVES:

COB1: Appraise the opportunities and challenges of Internet related environment.

COB2: Design Static Client website using markup languages and style sheets.

COB3: Analyze the advantages and use of Ajax.

COB4: Familiarize API Connection to Third party vendors.

COB5: Apply the PHP Framework and connect with MySQL database.

MODULE I   INTRODUCTION TO WWW   9

Introduction to Network, Internet and Intranet, Internet Addressing – IP, DNS, URL. Elements of Web – Web Page, Web Site, Web Client & Server. Introduction to Web Languages and Framework – HTML/DHTML, JavaScript, PHP, XML.

MODULE II   BUILDING WEBSITES USING HTML5 AND CSS   9

HTML5 Tags –HTML New Elements- Event Attributes – HTML5: Google maps, GEO Location - HTML Canvas Tag - Audio, Video. Introduction to Style sheet, Types of Style sheet, concept of class & ID, Different CSS Property- Background Property- Font property- Text –Dimensions - Borders-Margins- Padding-Box Model. CSS3-Box Model Background - Text Effects.

MODULE III   ADVANCED CLIENT SIDE SCRIPTING LANGUAGE   9

Concept and types of Scripting language, Introduction to Web Applications - Pre and Post Ajax, Ajax in the Real World, Alternatives to Ajax, XML In A Nutshell, Syntax, Rules, JavaScript In A Nutshell, Primitive Data Types and Reference Types, Variables Loops, Function Definition and Function Call, Objects, Expressions, Operators and Escape Sequences, Document Object Model (DOM), Window Object.

MODULE IV   SERVER SIDE SCRIPTING LANGUAGE   9

Introduction to PHP, Basic PHP Syntax: PHP tags, PHP statements and whitespace, comments, Operators, Conditional Structure, User Define Functions, Arrays. GET and POST Methods. Cookies, Session. Introduction to Github, API connection with third party vendors.

MODULE V   DATABASE AND ADVANCED PHP FRAMEWORK   9

PHP MyAdmin - Performing basic database operation (DML) (Insert, Delete, Update, Select) - Setting query parameter - Join (Cross joins, Inner joins, Outer Joins, Self joins.). Introduction to codeigniter - Understanding the MVC Pattern Models- Configuration CodeIgniter to work with database - Real time case study- Wordpress, Domain Registration and hosting.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2013.
2. Beginning PHP5, Apache, Mysql Web Development, Wrox, Elizabeth Naramore, Michael K. Glass, 2005.

REFERENCES:
1. Beginning JavaScript 2nd Edition, Wrox, Nicholas C. Zakas, 2004.
2. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005.
3. Beginning Ajax, Wrox, Chris Ullman, Lucinda Dykes, 2007.
4. Beginning JavaScript 2nd Edition, Wrox, Nicholas C. Zakas, 2004.
5. https://codeigniter.com/
6. For free hosting and Cpanel visit :   https://in.000webhost.com/

COURSE OUTCOMES:

CO1: Demonstrate the knowledge of fundamental element web and website and summarize the importance of web languages in the development of website.

CO2: Apply Ajax, JavaScript, HTML and CSS3 effectively to create interactive and dynamic websites.

CO3: Build web applications using PHP and submit the form using GET or POST method.

CO4: Determine numerous opportunities exist for API practitioners seeking connection with Third party vendors.

CO5: Develop Web Application using Codeignitor and able to connect and manipulate the MySQL database.

Board of Studies (BoS) :   **Academic Council:**
15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L							M						
CO2		M	H									M	M	M
CO3				L									L	
CO4		H		M	H						H	M	H	M
CO5			H		H				M			H	H	H

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

To analyze, design and develop Advance Web development skills taught in this course for the learners with respect to the course outcomes are measurable and implementable. Learners will Design the responsive websites, Webapps and to become a Web-App Developer through innovative approach.

CAD 7126

SDG: 9

CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

COB1: Introduce the basic concepts of Customer Relationship Management

COB2: Learn the different CRM Models and the art of making CRM Strategy.

COB3: Understand the present and changing patterns of e-CRM Solutions.

COB4: Select the appropriate CRM software tool and customize the operations

COB5: Apply CRM in various business verticals to provide business intelligence

MODULE I   INTRODUCTION   9

Evolution of Customer Relationship: CRM-Definition - Emergence of CRM Practice - Factors responsible for CRM growth - CRM process - framework of CRM - Benefits of CRM, Types of CRM, Scope of CRM, Customer Profitability, Features Trends in CRM, CRM and Cost Benefit Analysis.

MODULE II   CRM ROADMAP FOR BUSINESS APPLICATIONS   9

Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection – Models of CRM – CRM road map for business applications - Strategic CRM planning process – Implementation issues.

MODULE III   e-CRM SOLUTIONS   9

CRM - Issues and Strategies - Winning Markets through Effective CRM - CRM as a business strategy - Effective CRM through Customer Knowledge Management - Customer Interaction Management - Call Centre management in CRM. Customer Centricity in CRM - Customer life cycle Management. Components of e-CRM - Changing Patterns of e-CRM Solutions.

MODULE IV   SOFTWARE TOOLS FOR CRM   9

Sales Force Automation: Sales process – Activity Contact - Lead and Knowledge management - Sales fore CRM tool & Zoho CRM tool- CRM Links in E-Business - E-Commerce.

MODULE V   CASE STUDIES   9

Implementing CRM at Banking sectors – Microsoft CRM solutions - CRM in B2C

Market: Telecom – Airlines – Banking – Hospitality – CRM in Insurance.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Jagdish N Sheth, Parvatiyar Atul, G Shainesh, Customer Relationship Management: Emerging Concepts, Tools and Applications, 1st Edition, Tata McGraw Hill, June 2017.
2. G. Shainesh and Jagdish N. Sheth, "Customer Relationship Management: A Strategic perspective", Laxmi Publications; First edition January 2016.
3. V. Kumar, Werner Reinartz, "Customer Relationship Management Concept, Strategy and Tools", 3rd Edition, Springer Texts in Business and Economics, 2018.

REFERENCES:

1. Makkar, U. and Makkar, H.K., Customer Relationship Management, Tata McGraw-Hill Education, 2012.
2. Alok Kumar, Chhabi Sinha, Rakesh Sharma, "Customer Relationship Management: Concepts and applications", Dreamtech Press, 2007.

COURSE OUTCOMES:

CO1: Identify the right CRM frame work for the business vertical.

CO2: Select the right CRM strategy and model for the proposed system.

CO3: Integrate customer knowledge and interaction management.

CO4: Select the appropriate software tool and customize its operations to implement the proposed CRM model.

CO5: Derive business intelligence and insights from the vertical case studies

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22-06-2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			H											
CO2		M		H										
CO3									H					
CO4		L			H								H	
CO5			H							H				H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The course outcomes are measurable and help the learner to implement CRM solution methodologies to achieve the Sustainable development goal on Industry, Innovation and infrastructure. The proposed CRM solution by the learner would improve the customer retention capacity of the system. The innovative application of e-CRM s sales force automation and cost benefit analysis by the learner would also improve the business profitability.

CAD 7127

SDG: 4

PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

Student will be able to

COB1: Understand python basic operation using various   functions of Python

COB2: Identify the concepts of Strings and Files in Python.

COB3: Comprehend the Lists, Dictionaries and Tuple Concepts in Python.

COB4: Acquire the skills to build gaming logics in python environment.

COB5: Explore the features of PANDAS library used in python programming

PRACTICALS

List of Experiments:

1. Write a python program to implement the arithmetic operations for the following:
    - Addition
    - Subtraction
    - Multiplication
    - Modulus
    - Floor Division
2. Write a python program to implement the conditional statement for the following:
    - Fibonacci number series.
    - Incorporate FIZZ for any number divisible by 3 and Buzz for any number divisible for 5 and FIZZBUZZ for any number divisible by 3 and 5 as well.
3. Write a python program to implement the crowd computing using the array concept for the following scenario.
    - To collect approximate cost for a material or object and store the same in the array. Remove first and last 10 % of the listed cost from the array and compute the mean value of the array items.
4. Write a python program to implement looping concept, conditional statement and function to build a game called jumbled word.
5. Write a python program to implement random module to randomly generate 50 birth dates and find how many of them have same day of

the year.

6. List Programs(Python Lists & its Functionality)
   - Display of List with elements.
   - Finding the range of the Lists.
   - Indexing in the Lists (Including Negative Indexing).
   - Use of Loop in the Lists.
   - Adding, removing and Joining two Lists

7. Tuple Programs(Python Tuple & its Functionality)
   - Creation of Tuple with values.
   - Finding the range of the Tuple.
   - Indexing in the Tuple (Including Negative Indexing).
   - Use of Loop in the Tuple.
   - Adding, removing and Joining two Tuple

8. Dictionary Programs(Python Dictionary& its Functionality)
   - Display of unordered elements.
   - Accessing the elements in the dictionary.
   - Use of Loop in the Dictionary.
   - Adding, removing and Joining two Dictionary

9. Write a python program to convert speech to text.

10. Write a python program to create a game "MONTE HALL _ 3 - DOORS AND A TWIST". This comprises of three doors. In which two doors contain GOAT and one door contain BMW. User has to pick his/her choice of door. If the choice of door contains BMW then user WINS otherwise LOST.

11. Write a python program to implement visualization concept to plot the values in a chart with x-axis and y-axis.

12. Write a python program using pandas library to perform the following operation.
    - Create DataFrame
    - Manipulate the values in DataFrame
    - Barcharts
    - Pie Charts
    - Scatter Plots

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. Python: The Complete Reference by Martin C Brown - 20 March 2018.

REFERENCES:

1. Python Programming for Beginners: An Introduction to the Python Computer Language and Computer Programming (Python, Python 3, Python Tutorial) by Jasson Cannon, 2014.

COURSE OUTCOMES:

CO1: Learners can apply the acquired skill to compute fundamentals and mathematical concepts in python environment.

CO2: Can Identify, formulate, analyze and implement technical skills to solve real time problems.

CO3: To implement and analyze the statistics of the data using visualization concepts of python.

CO4: Implement and interpret the applications to explore the data insights using PANDAS.

CO5: Able to design and develop the software to meet the customer and industry requirements.

Board of Studies (BoS) :
15th BoS of CA held on 22.06.2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M						L						M
CO2	M	H	M					M					H	
CO3	M	H	H						H					M
CO4		H	M					M	H				H	
CO5	M		H		H							H		H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Programming concepts, plan & features are taught in this course for the learners with respect to the course outcomes are measurable and useful in improving the programming and logical skill of the learner. As the software industries growing rapidly, this course will enable the learner to explore various technologies such as web development, Artificial Intelligence, Data Science and IoT by using python programming.

CAD 7128	**MINI PROJECT**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

SDG: 9

COURSE OBJECTIVES:

COB1:Understand the Process of Software Engineering fundamentals

COB2: Address the problem and plan to collect data.

COB3: Describe the data structure to implement.

COB4:Fabricate and implement the project using web development tools

COB5: Understand the importance of document design by compiling Technical Report on the Mini Project work carried out

GUIDELINES

1. Students to know about Software Engineering Process fundamentals.
2. To handle huge volume of Structured and Unstructured Data using Big data.
3. Develop algorithms using Data Structures, Machine Learning Techniques and tools.
4. Implement an algorithm in Python, R Programming, J2EE, ASP, PHP and it can be stored in cloud environment.
5. The students undertake individual application project based on their interest level. The project coordinators must approve the projects.

REPORT AND DOCUMENTATION

1. Students must maintain a lab record and update the project progress on a weekly basis.
2. Must demonstrate during lab hours and update the project progress on a weekly basis.
3. Must submit a detailed project report as per the common template for a Project Viva-voce examination.
4. Monthly review will be conducted and evaluated by the coordinators.

PROJECT EVALUATION CRITERIA

The Project coordinators verify and validate the information presented in the project report. The split-up of marks is as follows:

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

COURSE OUTCOMES:

CO1: Apply the knowledge of software engineering Process fundamentals

CO2: Identify, Collect and analyse data using tools to solve the real world problems.

CO3: Develop an algorithm using Data Structure and Machine learning Tools and Techniques

CO4:Design and Develop the software according to the real world problem using User friendly language.

CO5: Demonstrate and build the project successfully by hardware requirements, Coding and testing.

Board of Studies (BoS) :
15th BoS of CA held on 26.06.2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H												M	
CO2	H	H		M	H	M			H	H	H	H	H	H
CO3		H	H		H				M	M	H		H	M
CO4			H		H	M	L		M	H	H	L	H	H
CO5					H	H	M	M	H	M	M	H	H	H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Learners have capacity – building to invest in innovation and in the development of clean and sound technologies in support of the sustainable development goals.

CAD 7221   **PROJECT WORK**   L   T   P   C

SDG: 9   0   0   36   18

COURSE OBJECTIVES:

COB1: Define the problem.

COB2: Analyze project requirements and draw respective design diagrams.

COB3: Write effective Code for User Interface design, Database Connectivity, Processing logic and Report generation.

COB4: Test and implement the code for all the modules.

COB5: Train the end user with system and user manual and complete the project Lifecycle with report generation.

PROJECT GUIDELINES

1. Identify and analyze the objective, scope, concept and feasibility of the project through literature review
2. Formulation of design and develop innovative solutions after identifying and analyzing problems
3. Develop software prototypes to prove the design as part of developing innovative products
4. Test the modules based on the risk and integrate all the Modules.
5. Discuss the results obtained to derive conclusions
6. Defend the work by preparing a report as per the University format
7. Compile the experimental results to publish in journals or conference
8. Perform multi-disciplinary task as an individual to manage the project.
9. Comprehend the project development with effective presentation and report
10. Interpret the findings with appropriate technological citation

COURSE OUTCOMES:

CO1: Define the real time problem/ research project scopes, objectives and deliverables with project schedule.

CO2: Design with a system modeling language tool and draw diagrams, covering all modules of the project.

CO3: Write effective programs to develop user interface design, database design, processing logic and generate reports.

CO4: Apply various software testing tools for the test cases and implement the project modules with a consolidated project report.

CO5: Demonstrate the working project to the end user with system and user manual.

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22.06.21   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1	H	H		M			M	M	H				H	H
CO2			H	H	H			H	H	H	M	M	H	H
CO3	H	H	H	M	H	M				H	H	H	H	H
CO4							H	H	H	H	M	H		H
CO5									H	H	L	H		

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Industry, Innovation and Infrastructure - Build infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The students can demonstrate creativity and innovation by employing valid and reliable research strategies. Utilize critical thinking to make sense of problems and persevere in solving them.

PROGRAMME ELECTIVES

SEMESTER II

CADY 251	DIGITAL MARKETING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Explain a systematic approach to develop a Digital Marketing strategy

COB2: Familiarize online marketing strategy integrated with overall marketing Objectives

COB3: Explore email marketing as an effective marketing change

COB4: Expose all the essentials of mobile marketing

COB5: Explore various strategic building process in digital marketing

MODULE I	DIGITAL MARKETING BASICS	9

Introduction to marketing-digital marketing and its principles-digital marketing wins over traditional marketing- CPR, CPM, PPC, CPC, SEO, SEM-UNDERSTANDING various Social channels- Digital Marketing Process-Increasing Visibility- Visitors Engagement-- Bringing Targeted Traffic- Converting Traffic into Leads- Retention - Performance Evaluation.

MODULE II	BUILDING WEBSITE AND SEARCH ENGINE OPTIMIZATION	9

Internet- web – websites-domain names-web server- web hosting- Planning and conceptualizing a website- Building website using CMS in class-SEO-SERPGoogle Keyword Planner tool- Google Operator- Content optimization & planningOn page Optimization- Off page Optimization-Local SEO- Google Webmaster Tools

MODULE III	ONLINE DISPLAY ADVERTISING AND ECOMMERCE MARKETING	9

Online advertising-display advertising- Banner ads- Rich Media ads- Pop ups and Pop under ads- Contextual advertising- Payment Modules- Online advertising platforms- Ecommerce- Top Ecommerce websites- Ecommerce scenario in Indiamarketing strategy- Mobile Marketing and Social Media-Using tools to create mobile websites- Content Marketing on mobile- SMS marketing-Uploading mobile app in Android and Ios

MODULE IV   CONTENT MARKETING   9

Content Marketing- steps in strategy building process- Optimizing content for search engines- authority blog- monetizing authority blog- unique ways to write magnetic headlines- Case study on content marketing.

MODULE V   ONLINE REPUTATION MANAGEMENT   9

Online reputation management- ORM scenario- Online reputation management Commandments- positive brand image online- tools for monitoring online reputation -overcome negative online reputation-Case Study

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. Alan Charlesworth, "Digital Marketing: A Practical Approach", Routledge Publication, 2nd Edition,2014
2. "Digital Marketers Sound Off: Tips, Tactics, Tools, and Predictions", Matt Chiera, 2018.

REFERENCES:
1. Dave Chaffey Et Al E marketing Excellence: Planning and Optimizing your digital marketing, Third Edition, 2008.

COURSE OUTCOMES:

CO1: List the advantages of digital marketing over traditional marketing.

CO2: Summarize how they can use digital marketing is used to increase sales and grow their business.

CO3: Analyze digital marketing toolkit

CO4: Familiarize elements of the digital marketing plan

CO5: Develop online target market and basic digital marketing objectives

Board of Studies (BoS) :
14th BoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L							H						H
CO2		M	H											H
CO3				H				M						H
CO4							H	H		M				H
CO5								M	L		H	H		H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Digital technologies place people at the center of products and services, allowing for attractive offerings due to reduced costs, improved sustainability, and user-friendliness Technologies at issue enable new business models that enhance innovation and growth in a wide range of sectors.

CADY 252

SDG: 9

MANAGEMENT INFORMATION	L	T	P	C
SYSTEM	3	0	0	3

COURSE OBJECTIVES:

COB1: Introduce the concepts of Machine System.

COB2: Understand the Structure of Organization.

COB3: Learn to make decisions.

COB4: Know about the storage devices and file organizations.

COB5: Become familiar with development and management of project.

MODULE I   **SYSTEM CONCEPTS**   **9**

Definition – Computer based user machine system – Integrated system – Need for a database – Utilization of models – Evolution – Subsystems – Organizational subsystems – Activities subsystems.

MODULE II   **ORGANIZATIONAL STRUCTURE**   **9**

Basic model – Hierarchical – Specialization – Formalization – Centralization – Modifications of basic organizational structure – Project organization – Lateral relations – Matrix organization – Organizational culture and power organizational change.

MODULE III   **STRUCTURE OF MIS**   **9**

Operating elements – Physical components – Processing functions – outputs– MIS support for decision making – Structured programmable decisions – Unstructured non-programmable decisions – MIS structure based on management activity and organizational functions – Synthesis of MIS structure.

MODULE IV   **SYSTEM SUPPORT**   **9**

Data representation – Communication network – Distributed systems – Logical data concepts – Physical storage devices – File organizations – Data base.

MODULE V   **DEVELOPMENT AND MANAGEMENT**   **9**

A contingency approach to choosing an application – Developing strategy – Lifecycle definition stage – Lifecycle development stage – Lifecycle installation and operation stage – Project management.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. James A, O'Brien, George M. Marakas , Ramesh Behl, "Management Information Systems", 10thEdition, Mcgraw Hill, 2017.
2. Harold Koontz, Heinz Weihrich, "Essentials of Management", 5th Edition, Tata McGraw Hill 1998.

REFERENCES:

1. E.Wainright Martin, Carol V. Brown, Danial W. DeHayes, Jeffrey A. Hoffer, William C. Perkins, "Managing Information Technology" 3rd Edition, Prentice Hall International edition 1999.

COURSE OUTCOMES:

CO1: Learn the basics of Machine System.

CO2: Understand the Organization structure.

CO3: Identify the decisions for MIS.

CO4: Familiar with Storage devices and its organization.

CO5: Able to develop a Project and maintain.

Board of Studies (BoS) :

14th BoS of CA held on 06.06.2020

Academic Council:

15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		L		H									M	
CO2					H						M		M	
CO3							H						M	
CO4		M		M										H
CO5									M			H		H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Develop the managing skills with respect to the course outcomes and improve the organization development skill of the learner. This would help the learner in developing spaces for community get-togethers.

CADY 253

SDG: 9

MULTIMEDIA SYSTEMS AND COMPUTER GRAPHICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

COB1: Explain the basic concept of multimedia and its hardware / software.

COB2: Explore the various multimedia tools and its usage

COB3: Familiarize the importance of internet in multimedia applications.

COB4: Introduce basic graphics and design algorithms.

COB5: Illustrate the concept of 2D and 3D transformation.

MODULE I   INTRODUCTION   9

Definition - CD-ROM and multimedia-Multimedia applications: business – schools - Homes - public places and virtual reality. Introduction to making of multimedia: hardware - software - creativity - and organization.

MODULE II   MULTIMEDIA TOOLS   9

Macintosh and windows production platforms - 3-d modelling and animation - image- editing tools - sound editing tools - animation - video - and digital movie tools - linking multimedia objects - office suites - word processors - spread sheets - databases - presentation tools. Authoring tools - Card and Page-based authoring tools - Icon Based authoring tools - time based authoring tools - object oriented authoring tools - cross platform-authoring tools.

MODULE III   MULTIMEDIA AND THE INTERNET   9

Internet fundamentals: Internetworking – Connections – Internet services – The World Wide Web – Tools for the World Wide Web: Web serves – Web browsers – Web page makers and Site builders – Plug-ins and Delivery vehicles – Beyond HTML.

MODULE IV   GRAPHICS PRIMITIVES   9

Introduction Overview of Graphics System – Bresenham technique – Line Drawing and Circle Drawing Algorithms – DDA – Line Clipping – Text Clipping.

MODULE V   2D AND 3D TRANSFORMATIONS   9

Two dimensional transformations – Scaling and Rotations – Interactive Input

methods – Polygons – Splines – Bezier Curves Window view port mapping transformation – 3D Concepts – Projections.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. Tay Vaughan," Multimedia: Making It Work", 8th Edition, 2011, McGraw-Hill (Unit 1, Unit 2 and Unit 3)
2. Hearn D and Baker M.P, "Computer graphics – C Version", 2nd Edition, Pearson Education, 2004 (Unit 4 and 5)

REFERENCES:
1. K. Andleigh and K. Thakkrar , "Multimedia System Design", 1996, Prentice Hall PTR
2. Steve Rimmer, "Advanced multimedia programming", Windcrest /McGrawHill, 1995.

COURSE OUTCOMES:

CO1: Analyze the technical aspect of Multimedia Systems.

CO2: Develop various Multimedia Systems application for real time scenario.

CO3: Apply various networking protocols for multimedia applications.

CO4: Evaluate multimedia application for its optimum performance.

CO5: Create a multimedia component using various tools and techniques.

Board of Studies (BoS) :
14th BoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H				M				L		M			H
CO2			M		M	H				M				M
CO3			L	M						L		L	M	
CO4	H	M		M					M				M	L
CO5		L		M						M		H		L

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Designing and developing skills taught in this course with respect to the course outcomes improve the analytical knowledge and innovation of the learner. It would create a variety of ways for the learner to progress and can help significantly improve the quality of the learner.

CADY 254   **ORGANIZATIONAL BEHAVIOUR**   L   T   P   C

SDG: 9   3   0   0   3

COURSE OBJECTIVES:

COB1: To enable the students to understand the leadership and its goals towards the organizational behaviour.

COB2: To understand the concepts, principles and techniques relating to different functional   areas of organizational behaviour.

COB3: To identify the major frames of reference on conflicts.

COB4: To enable the students to create an awareness on ethics and human values, to know moral and social values and loyalty.

COB5: To enable the students to be more innovative and get the rewards for hardwork.

MODULE I   LEADERSHIP   9
Characteristics of leadership - Technical Leadership - Leader's Goal, Conviction, Vision – Leadership Styles: Transformational and Transactional Leadership - Leader's Vision - Professionalism: Importance, Elements - Managing Awareness - Performance - Manager's Role in Professionalism.

MODULE II   TALENT MANAGEMENT   9
Talented Professionals – Importance - Characterization - Identification – Assessment and Recognizing Talent- - Purpose of Talent Management - Talent management process - Development - Development Needs – Counseling and Mentoring.

MODULE III   CONFLICT MANAGEMENT   9
Reasons for conflict- Conflict frames of reference - Conflict levels and cause - Conflict management: resolution approaches, stimulation approaches - Organizational justice: Components, Consequences - work behaviours: citizenship behaviour, Counter-productive behaviour.

MODULE IV   ETHICS IN ORGANIZATION   09
Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory –

Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

MODULE V   INNOVATION AND RECOGNITION   9

The Importance of Innovation - Risk of Failure - Nature of Creativity - Imagination- Managing Innovative Teams - Needs of Creative Teams - Team Dynamics - Innovative Team Environment -Award Programs - Recognition Programs - Industry Award Plans - Award Guidelines – Incentive Plans.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. David A. Buchanan, Andrzej A. Huczynski, Organizational Behaviour, Pearson Education Limited, United Kingdom, 10th edition 2019.
2. Meliha Nurdan Taskiran and Fatih Pinarbaşi Istanbul Medipol University, Turkey Multidisciplinary Approaches to Ethics in the Digital Era, IGI Global book series Advances in Information Security, Privacy, and Ethics (AISPE), 2021.
3. Watts S. Humphrey, "Managing Technical People: Innovation, Teamwork, and the Software Process", Addison-Wesley, 1996.

REFERENCES:
1. Carolina Machado, J. Paulo Davim, Organizational Behaviour and Human Resource Management, Springer International Publishing, 2018.
2. Laura P. Hartman and Joe Desjardins, Business Ethics: Decision Making for Personal Integrity and Social Responsibility, Mc Graw Hill education, India Pvt. Ltd. New Delhi, 2013.
3. World Community Service Centre, Value Education, Vethathiri publications, Erode, 2011.
4. Saiyadain, M.S. Organizational Behaviour, Tata McGraw Hill, 2009.
5. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi, 2003.

COURSE OUTCOMES:

Students would be encouraged

CO1: to work in team, to lead a team and come up with more innovative ideas.

CO2: to perform as a team leader and team member with technical skills.

CO3: to manage the organizational conflicts.

CO4: to know the human values, moral values, social values and loyalty in an organization.

CO5: to come up with more innovative ideas.

Board of Studies (BoS) :
14th BoS of CA held on 06.06.2020

Academic Council:
15th AC held on 25.06.2020

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1		L					M		H	H	M	M	L	M
CO2							M	M	M	L	H		H	M
CO3							H		M					
CO4						H		H	M					
CO5								M		H	M	H	M	M

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build a strong infrastructure, encourage the complete and sustainable industrial developments and innovations.

The purpose of the organizational behaviour is to develop an ongoing and constructive interchange among organizational behaviour scholars and practitioners to conduct research that is relevant for management theory and practice in the contemporary world. The organizational behaviour aims at promoting research and interests in individual behaviour as well as group behaviour in the organizational context by providing a wide-ranging, engaged and internationally-focused forum to discuss and develop research and practice in the field.

CADY 255   **CYBER SECURITY**   L   T   P   C

SDG: 9   3   0   0   3

COURSE OBJECTIVES:

COB 1: Introduce the fundamentals of security.

COB 2: Impart the concepts of network security.

COB 3: Analyze the counter measures used in cyber security.

COB 4: Comprehend on cyber crime and the governing cyber laws.

COB 5: Deploy security solutions using cyber tools.

MODULE I   **INTRODUCTION**   **9**

Introduction to security, basic principles of confidentiality, availability and integrity. Threats, vulnerabilities, authentication, access control. Cryptography – basics, symmetric and asymmetric algorithms. Cyber security – basics and purpose of cyber security.

MODULE II   **SECURITY IN NETWORKS**   **9**

Network security – introduction to threats and attacks in a network communication, Threats- deliberate hardware and software attacks, Viruses, Espionage and trespass, sabotage and vandalism. Attacks-Malicious Codes, Ransomware, Denial of Service and Distributed Denial of Service, Spoofing, sniffing, Spam, Social Engineering.

MODULE III   **CYBER SECURITY AND COUNTERMEASURES**   **9**

Cyber security countermeasures – fundamentals, selecting appropriate measures, types and benefits, Antivirus, Spyware detection, Network monitoring, Intrusion Detection System, Intrusion Prevention System, Firewalls. Risk management – identification, control and accessing risk.

MODULE IV   **CYBER CRIME AND SECURITY GOVERNANCE**   **9**

Cybercrime – Identity theft, corporate spies, privacy concepts, invasion of privacy, privacy on the web, internet fraud, counterfeiting and forgery. Hacking – Fundamentals, types. Attack vectors. Cyber security laws, principles, regulations. Penalties, corporate governance, litigation, insurance, Investigatory and policy powers.

MODULE V   **CASE STUDIES AND DEPLOYMENT**   **9**

Case Studies on – Data breaches, attacks on social media (facebook), password phishing attacks, Unpatched software, Ransomware. Deployment: Kali Linux –

Information gathering tools, password cracking tools, Wireshark tools and Autospy.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. Ben McCarty, "Cyberjutsu: Cybersecurity for the Modern Ninja", No Starch Press Publishers, USA, April 2021.
2. Nitul Dutta, Nilesh Jadav, Sudeep Tanwar, Hiren Kumar Deva Sarma, Emil Pricop, "Cyber Security: Issues and Current Trends (Studies in Computational Intelligence)", Springer Publications, USA, First Edition, 2021.

REFERENCES:
1. Kim Crawley, "8 Steps to Better Security: A Simple Cyber Resilience Guide for Business", Wiley Publications, First Edition, 2021.
2. Kent Peterson, "Cybersecurity, Cyberwar and Cyberweapon: A Beginner's guide to understanding cyber security and how it affects you", Independently published, 2021.

COURSE OUTCOMES:
CO1: Understand the fundamentals of security.
CO2: Build a secure network for communications.
CO3: Explore the counter measures for providing cyber security.
CO4: Interpret the importance of cyber governance.
CO5: Apply the security measures using the cyber tools.

Board of Studies (BoS) :
16th BoS of CA held on 23.12.2021

Academic Council:
18th AC held on 24.02.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			M		M									M
CO2				M	H	L							M	M
CO3			M	H		M		M						M
CO4						H	M	H			M		H	M
CO5				M	M	M			M				H	H

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation .

Statement: Get to know about the basics of security. This course helps the student to gain knowledge about cyber security in detail. Analyzing the cyber laws helps them to understand the boundaries. Applying the cyber security tools helps the students to prepare for the placement drive.

SEMESTER III

CADY 352	MOBILE SECURITY	L	T	P	C
		3	0	0	3

SDG: 9

COURSE OBJECTIVES:

COB1: Understand fundamental mobile computing principles, and models and mobile computing security principles.

COB2: Understand the fundamental elements and role of encryption in mobile application and device security, and describe common scenarios where encryption processes are applied

COB3: Gain in-depth knowledge on wireless and mobile network security and its relation to the new security-based protocols.

COB4: Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

COB5: Design secured wireless and mobile networks that optimize accessibility whilst minimizing vulnerability to security risks.

MODULE I   INTRODUCTION   9

Introduction: Confidentiality, Integrity and Availability Threats in Mobile Phones, Perceptions, and Awareness Regarding Mobile Phone Security, Voice, SMS, and Identification Data Interception in GSM, SMS Security Issues.

MODULE II   NETWORK AUTHENTICATION   9

Authentication, Encryption/Decryption in GSM, Securing the WLAN, WEP Introduction, RC4 Encryption, Data Analysis, IV Collision, Key Extraction, WEP Cracking, WPA/ WPA2, AES, Access Point-Based Security Measures, Third- Party Security Methods, Funk's Steel-Belted Radius, WLAN Protection Enhancements.

MODULE III   SECURITY ISSUES   9

Basic security and cryptographic techniques - Security of GSM Networks-Security of UMTS Networks - LTE Security- Blue-tooth Security Implementation, Security in Wi-MAX, UWB security, Satellite Network Security.

MODULE IV   SECURITY TYPES   9

Introduction to Mobile Security-SIM/UICC Security. Mobile Malware and App Security Android Security Model. IOS Security Model. Security Model of the Windows Phone. SMS/MMS, Mobile Geolocation and Mobile Web Security. - Security of Mobile VoIP Communications -Emerging Trends in Mobile Security.

MODULE V   SECURITY THREATS   9

Security Threats and Vulnerabilities - Virus - Trojan - Rootkits - Backdoors - Botnets - Man in the middle attack - Dos and DDos - Replay attack - Spoofing - Spam - Phishing - privilege escalation - DNS poisoning - Brute force - Dictionary attack - Cross-site scripting - SQL injection - Zero-day attack - Session hijacking - Vulnerability scanning vs Port Scanning - Honeypots - Banner grabbing - Social Engineering.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Andreoulakis, Iosif I, Mobile Phone Security and Forensics, A Practical Approach, 2012.
2. Chris Clark and David Thiel, Mobile Application Security, Himanshu Dviwedi, 1st Edition.

REFERENCES:

1. Hideki Imai, Mohammad Ghulam Rahman and Kazukuni Kobari "Wireless Communications Security", Universal Personal Communications of Artech House, 2006.
2. Stallings William, "Wireless Communications and Networks" Second Edition, Pearson Education Ltd, 2009.
3. Noureddine Boudriga, Security of Mobile Communications, 2009.

COURSE OUTCOMES:

CO1: Identify and investigate in-depth both early and contemporary threats to mobile and wireless networks security.

CO2: Analyzing the fundamental elements and role of encryption in mobile application and device security.

CO3: Apply proactive and defensive measures to deter and repel potential threats, attacks and intrusions.

CO4: Develop a clear view of integrated security environments consisting of both similar and diverse wireless access technologies and security architectures.

CO5: Understand common threats and vulnerabilities related to mobile computing networks, and explain the concepts of defending against and managing network attacks.

Board of Studies (BoS):

15th BoS of CA held on 22.06.2021

Academic Council:

17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2
CO1													M	
CO2	L				M									
CO3								M						L
CO4			M				M							
CO5								M			H		M	M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

By learning the fundamentals of mobile computing and model sand security principles, which helps to develop an integrated security system consisting of both similar and diverse wireless access technologies in mobile applications.

| CADY 353 | **MOBILE AND DIGITAL** | L | T | P | C |
| SDG: 9 | **FORENSICS** | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

COB1: The course will incorporate the foundational understanding of Digital mobile forensics.

COB2: Understand the fundamentals and advanced issues of various threats faced by today's Mobile cyber operation infrastructure.

COB3: Students will get to know the functionality of mobile network forensics and explore their technical operations.

COB4: Learn the technical functions that reside on mobile devices with various operating systems.

COB5: Illustrate the importance of report generations with real-time case studies.

| MODULE I | INTRODUCTION TO DIGITAL MOBILE FORENSICS | 9 |

Introduction to Digital Mobile Forensics: Mobile forensic challenges- Mobile phone evidence extraction process. Chain of Custody: Identification phase - Preparation phase - Isolation phase - Processing phase-Verification phase - Document and reporting phase-Presentation phase.

| MODULE II | MOBILE FORENSICS | 9 |

Mobile Device Forensics: Understanding Mobile Device Forensics-Mobile Phone Basics- Inside Mobile Devices-Understanding acquisition procedures for Mobile Devices-Mobile Forensics Equipment-Using Mobile Forensics Tools.

| MODULE III | NETWORK MOBILE FORENSICS | 9 |

Cellular Networks: Types of Cellular Networks- Mobile Operating Systems-Cell Phone Evidence- Call Detail Records- Collecting and Handling Cell Phone Evidence- Subscriber Identity Modules(SIM)- Cell Phone Acquisition: Physical and Logical techniques- Cell Phone Forensic Tools- Global Positioning Systems (GPS)-Case study.

| MODULE IV | OPERATING SYSTEMS IN MOBILE FORENSICS | 9 |

Mobile operating systems overview: Procedures for handling an Android device -How to Circumvent the Pass Code-Recovery mode. Data Acquisition

from iOS Devices- Operating modes of iOS devices- Recovery mode. Windows Phone Forensics- Windows Phone OS- Security model- Windows Phone file system- Extracting SMS and application data.

| MODULE V | REPORT WRITING FOR HIGH-TECH INVESTIGATIONS | 9 |

Understanding the Importance of Reports: Types of Reports- Guidelines for Writing Reports- Preliminary Reports- Report Structure- Designing the Layout and Presentation of Reports- Examination and Data Collection Methods- Real time case study- Incident specific procedures.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Rohit Sharma "Practical Mobile Forensics": Forensically investigate and analyze iOS, Android, and Windows 10 devices, 4th Edition Paperback – Import, 9 April 2020.
2. Satish Bommisetty ,Rohit Tamma ,Mahalik "Mobile forensics: Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices", 4th edition, 21 July 2014.
3. Nelson B, Phillips, Enfinger F, Stuart C., "Guide to Computer Forensics and Investigations", 2nd ed., Thomson Course Technology, ISBN: 0-619-21706-5, 2006.
4. John Sammons, Jonathan Rajewski, "The Basics of Digital Forensics the Primer for Getting Started in Digital Forensics", SYNGRESS, Elsevier, ISBN 978-1-59749-661-2, 2012.

REFERENCES:

1. Andrew Hoog John McCash," Android Forensics Investigation, Analysis, and Mobile Security for Google Android", SYNGRESS, Elsevier, 2011.
2. Androulidakis, Iosif I. "Mobile Phone Security and Forensics A Practical Approach "ISBN 978-3-319-29742-2, Springer, 2016.

COURSE OUTCOMES:

CO1: Conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.
CO2: Identify and apply current practices for data discovery, recovery and acquisition.

CO3: Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to protect computer network resources from unauthorized activity.

CO4: Learn and explore on the details of what resides on mobile devices in technical aspects.

CO5: Acquire knowledge on report writing and open up ways to ccommunicate effectively to both technical and non-technical audiences.

Board of Studies (BoS):   **Academic Council:**

15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1								H			H		M	
CO2			L											H
CO3					H		H	H				H		M
CO4					H			M			M			
CO5										M		H		

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable, industrialization and foster innovation.

The student would be able to do the chain of investigation steps that need to be ensured for Confidentiality, Integrity, Authenticity, and legal acquisition of any form of digital evidence from mobile devices. The outcomes of the course are measurable and able to meet real-time cases. Also, would enable the learner to have functioned in forensic sectors with phenomenal technical ideas.

CADY 357	**CLOUD SECURITY**	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Introduce and Assess the key security and compliance challenges.

COB2: Analyze the Security Architecture and Evaluate Risk issues.

COB3: Depicts Security Management framework and the standards.

COB4: Appraise the management of a business physical cloud Environment.

COB5: Review the usability and Integrity of a network and its data.

MODULE I	SECURITY FUNDAMENTALS AND CHALLENGES	9

Cloud Computing Software Security Fundamentals: Cloud Information Security Objectives – Cloud Security Services – Relevant Cloud Security Design Principles – Secure Cloud Software Requirements – Approaches to Cloud Software Requirement Engineering – Cloud Security Policy Implementation – Secure Cloud Software Testing – Cloud Penetration Testing – Regression. Cloud Computing Security Challenges: Security Policy Implementation – Policy Types – Computer Security Incident Response Team (CSIRT) – Virtualization Security Management.

MODULE II	SECURITY ARCHITECTURE AND RISK ISSUES	9

Cloud Computing Security Architecture: Architectural Considerations – Identity Management and Access Control – Autonomic Control. Cloud Computing Risk Issues: The CIA Triad – Privacy and Compliance Risks – Threat to Infrastructure, Data and Access Control – Cloud Service Provider Risks.

MODULE III	SECURITY MANAGEMENT	9

Security Management in the Cloud: Security Management Standards-Availability Management – SaaS Availability Management – PaaS Availability Management – IaaS Availability Management – Access Control – Security Vulnerability, patch, and Configuration Management.

MODULE IV	DATA AND CLOUD ASSET MANAGEMENT	9

Data Asset Management and Protection: Data Identification and Classification- Data Asset Management in the Cloud - Protecting Data in

the Cloud. Cloud Asset Management and Protection: Differences from Traditional IT – Types of Cloud Assets – Asset Management Pipeline – Tagging Cloud Assets.

MODULE V   NETWORK SECURITY   9

Network Security: Differences from Traditional IT – Concepts and Definitions – Sample Application. Detecting ,Responding to, and Recovering from Security Incidents: Differences from Traditional IT – What to Watch – How to Watch – Preparing for an Incident – Recovery – Example Metrics – Example Tools for Detection , Response, and Recovery.

TOTAL HOURS – 45

TEXT BOOKS:
1. Chris Dotson , "Practical Cloud Security" O'Reiliy Media; (ISBN : 978-1-492-03751), 2019.
2. Ronald L. Krutz and Rusell Dean Vines "Cloud Security – A Comprehensive Guide to Secure Cloud Computing" Wiley Publication (ISBN : 978-0-470-58987-8), 2 nd Edition 2021.
3. Tim Mather, Subra Kumarasway, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risk and Compliance " O'Reiliy Media; (ISBN :0596802765), 2009.

REFERENCES:
1. John R.Vacca "Cloud Computing Security:Foundation and Challenges" CRC Press; ISBN [918-0-429-05512-6] , 2016.
2. Timothy Grance, Wayne Jansen; NIST "Guidelines on security and Privacy in public Cloud Computing" ,2011.
3. J.R.("Vic")Winkler, "Securing the cloud" Syngress (ISBN : 1597495921], 2011.

COURSE OUTCOMES:

CO1: Understand the key dimensions of the challenges and benefits of Cloud Computing.

CO2: Design Secure cloud Architectures and implement various core security controls for Cloud Computing.

CO3: Create a secure – minded workforce and protect the Organization Reputation.

CO4: To track and use tools of every aspects of cloud estate, Managing the maintenance, Compliance and disposal of Cloud.

CO5: Determine numerous opportunities that exist for practitioners seeking to create solutions for cloud computing.

Board of Studies (BoS) :
15th BoS of CA held on
22.06.2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H				M								M	
CO2		H	H			M							H	
CO3			H					M						
CO4					H			H						H
CO5				H							M		H	M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Learners will be able to create, design develop, maintain, upgrade and continuously improve secure Infrastructure. Learners will have the capacity to build secured infrastructure and contribute innovatively in the development of clean and sound technologies with the support of the sustainable development goals.

CADY 358

SDG: 9

INFORMATION STORAGE AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

COB1: Introduce the concepts of the Storage architecture and Information Lifecycle

COB2. Understand the basic components of Data Center Environment and apply Database management system

COB3: Distinguish between different types of Intelligent Storage Systems

COB4: Learn to deploy the proposed system in cloud

COB5: Provide security for Storage Infrastructure and Cloud Environments.

MODULE I   INTRODUCTION TO STORAGE SYSTEMS   9

. Overview of information storage, Evolution of storage Architecture, Information Lifecycle Management concept, Data Center Infrastructure, Virtualization and Cloud Computing.

MODULE II   DATA CENTER ENVIRONMENT   9

Application, Database Management System, Host (Compute), Connectivity, Storage, Disk Drive Components, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing.

MODULE III   INTELLIGENT STORAGE SYSTEMS   9

Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems, Intelligent Storage Array.

MODULE IV   CLOUD COMPUTING   9

Cloud Enabling Technologies, Characteristics and Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges.

MODULE V   SECURING THE STORAGE INFRASTRUCTURE   9

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Prachi S. Deshpande , Subhash C. Sharma , Sateesh K. Peddoju, Security and Data Storage Aspect in Cloud Computing (Studies in Big Data, 52) 1st ed. 2019.

2. G. Somasundaram, Alok Shrivastava, EMC Education Services, Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments 2012, 2nd Edition, Wiley publications.

REFERENCES:

1. Robert Spalding, Storage Networks: The Complete Reference, 2017, McGraw Hill Education.

COURSE OUTCOMES:

CO1: Design the storage architecture for the information.

CO2:.Retrieve data from the storage and analyze with database management system.

CO3: Apply the concepts of intelligent storage techniques

CO4: Store and Manage data in a cloud.

CO5: Provide storage security to the Information Storage System

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22-06-2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			H											
CO2		M											H	
CO3					H									
CO4													H	
CO5			M											M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9 : Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The course outcomes achieve the Sustainable Development Goal of providing basic infrastructure in Information, Communication Technologies-ICT. The learner of this course would be proficient enough to provide information storage solution with innovative application of concepts learned in the above course.

CADY 360   **CONTENT MANAGEMENT SYSTEMS**   **L   T   P   C**

SDG: 4   **3   0   0   3**

COURSE OBJECTIVES:

COB1: To impart knowledge in installing CMS and how CMS differ from website builder

COB2: To introduce the design layout and create the functionality with correct permissions

COB3: To train the student on the e-commerce workshop and trouble shooting

COB4: Provide knowledge on the core modules, using Smarty to build templates with own functionality

COB5: To train the students in using an open source content management (CMS) tool – Joomla, A powerful and robust tool.

MODULE I   INTRODUCTION   9
Content Management System (CMS) – Introduction - Getting Started - CMS versus website builder – Creating Pages and Navigation.

MODULE II   DESIGN AND TROUBLESHOOTING   9
Design and Layout - Using Core modules – Users and Permissions – Using Third-party Modules – Creating Own Functionality - E-commerce workshop - Advanced Use of CMS - Administration and Trouble Shooting.

MODULE III   WEB PAGE ADMINISTRATION   9
Introduction to dynamic web pages and development tools for dynamic content– Downloading tools for dynamic content – Downloading and installing a content Management System (Joomla!) – Administration elements of a Content Management System – Organizing Content.

MODULE IV   WEB CONTENT MANAGEMENT SYSTEM   9
Introduction to Word Press - WordPress.org vs. WordPress.com - Installing Word Press - Exploring the admin interface - Content creation: Posts vs. pages - Content customization: images, video, audio, tags, formats.

MODULE V   CASE STUDY   9
Basic elements: pages, menus and navigation – incorporate components, modules, plug-ins and languages – Case Studies: Marketing strategies and planning for

websites – Design and create a school website, restaurant website, blog site, e-commerce business website - Securing Content Management System.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:
1. CMS Made simple 1.5, Sofia Hauschildt, 2010.
2. Joomla! 1.5: A User's Guide – Barrie M. North Second Edition, Prentice Hall.

COURSE OUTCOMES:
CO1: Apply the knowledge to build a CMS for a real-time website.
CO2: Design and develop the e-commerce software to meet the customer and industry needs.
CO3: Use latest software and tools for creating an interactive mechanism and satisfy the needs of e-commerce industry and society.
CO4: Develop administration capability to deal as individual member or team to manage the projects in the website development process.
CO5: By inculcating the fundamental concepts of CMS will pave a way to become an entrepreneur in the software domain.

Board of Studies (BoS) :
15th BoS of CA held on 22-06-2021

Academic Council:
17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	L	H		H									H
CO2			H		H	M								H
CO3	M		H		H								M	
CO4			H						H	M	M			M
CO5			M									H		M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Website Content Management concepts are taught in this course for the learners with respect to the course outcomes is measurable and useful to improve the website design and development skill of the learner. As the e-commerce and e-learning industries growing rapidly, this course will enable the learners to explore the various technologies to understand and implement the on demand software for the benefit of the learners and society.

CADY 361   **PHP PROGRAMMING**   L   T   P   C

SDG: 4   3   0   0   3

COURSE OBJECTIVES:

COB1: Introduce the concepts of PHP and its structure.

COB2: Learn to design forms using HTML.

COB3: Understand the use of Java script with PHP.

COB4: Know about the working of sessions and cookies and get familiar with database connectivity.

COB5: Get to understand the web development framework.

MODULE I   INTRODUCTION   9

Introduction to PHP – Evaluation of PHP, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html. Array Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach (), Some useful Library function.

MODULE II   HANDLING HTML FORMS   9

Form Handling –PHP Interactive Forms-PHP GET & POST-Form Validation-PHP Form sanitization-PHP Form URL/E-mail –Basics of Computer Graphics-Creating Image-Manipulating Image-Using Text in Image-Watermarks to Image.

MODULE III   JAVA SCRIPT WITH PHP   9

JavaScript - Variables, data types, expressions, operators; Conditional, iteration, statements; Functions; Arrays; DOM, Events, Events Handling; Client-side Persistence; Object-Oriented JS; Ajax. Overview of JavaScript Libraries / Frameworks.

MODULE IV   DATABASE CONNECTIVITY   9

Session and Cookie – Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session. Database Management –Introduction to MySQL –MySQL Commands – MySQL Database Creation –Connecting MySQL and PHP –Querying MySQL Database with PHP.

MODULE V   WEB DEVELOPMENT FRAMEWORKS   9

Web Development Frameworks –Introduction – Model View Controller – PHP framework–PHP XML Parsers-PHP XML Expat-PHP XML DOM-PHP Mail – Pilot Project.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Robin Nixon, Learning PHP, MySQL & JavaScript 5e: With jQuery, CSS & HTML5 (Learning PHP, MYSQL, Javascript, CSS & HTML5), 5th edition, O Reilly Publishers, USA, 2018.

2. Luke Welling, Laura Thomsan, PHP and MySQL Web Development (Developer's Library), Pearson Education Publishers, 5th edition, US, 2017.

3. Mike McGrath, PHP & MySQL in easy steps: Covers MySQL 8.0, 2 nd edition, In Easy Steps Limited Publishers, India, 2018.

REFERENCES:

1. Steven Holzner, PHP: The Complete Reference, McGraw Hill Education, India,2017

2. John Duckett, PHP & MySQL: Server-side Web Development, Wiley Publishers, 1 st edition, USA, 2021.

COURSE OUTCOMES:

CO1: Implement the basics of PHP programming.

CO2: Apply the studied form designing features to develop forms using HTML.

CO3: Identify the role of Java script in developing web pages.

CO4: Familiarize with sessions, cookies and gain knowledge of establishing database connectivity with PHP.

CO5: Develop a web page using PHP and deploy it.

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		L	H											H
CO2			M		H								M	
CO3	L				H									H
CO4					M	H								H
CO5									M			M		H

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Designing and programming skills taught in this course with respect to the course outcomes improves the software development skill of the learner. This would help the learner in developing software using his knowledge in the web development.

CADY 371   **FULL STACK DEVELOPMENT**   L   T   P   C

SDG: 9   3   0   0   3

COURSE OBJECTIVES:

COB1: Explain the basic concept of HTML and CSS

COB2: Explore the various Full stack tools and its usage

COB3: Familiarize the importance React Hooks to build interactive and complex user interfaces

COB4: Build scalable full stack applications designed to meet demands of modern users

COB5: Illustrate the concept of SQL and NOSQL

MODULE I   HTML AND CSS   9

Introduction to HTML-Browsers and HTML-Editor's Offline and Online-Tags, Attribute and Elements-Doctype Element-Comments-Headings, Paragraphs, and Formatting Text-Lists and Links-Images and Tables Introduction CSS-Applying CSS to HTML-Selectors, Properties and Values CSS Colors and Backgrounds-CSS Box Model-CSS Margins, Padding, and Borders, CSS Text and Font Properties-CSS General Topics

MODULE II   JAVA SCRIPT   9

Introduction to JavaScript-Applying JavaScript (internal and external)-Understanding JS Syntax-Introduction to Document and Window Object -Variables and Operators, Data Types and Num Type Conversion-Math and String Manipulation-Objects and Arrays-Date and Time-Conditional Statements-Switch Case-Looping in JS-Functions

MODULE III   REACT JS   9

Introduction-Templating using JSX-Components, State and Props-Lifecycle of Components-Rendering List and Portals-Error Handling-Routers-Redux and Redux Saga-Immutable.js-Service Side Rendering-Unit Testing-Webpack

MODULE IV   NODE JS   9

Node js Overview-Node js - Basics and Setup-Node js Console-Node js Command Utilities-Node js Modules-Node js Concepts-Node js Events-Node js with Express js Node js Database Access

MODULE V   MANGODB   9

SQL and NoSql Concepts-Create and Manage DB-SQL Queries-SQL Database-MySQL Create Table-Select Statement-Where Clause-Order by in MYSQL

L – 45, TOTAL HOURS – 45

TEXT BOOKS:

1. Hands-On Full Stack Development with Spring Boot 2 and React: Build modern and scalable full stack applications using Spring Framework 5 and React with Hooks, 2nd Edition 2nd Edition, Kindle Edition

REFERENCES:

1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker 1st ed. Edition Steve.

COURSE OUTCOMES:

CO1: Analyze the technical aspect of Full Stack development.

CO2: Understand how to use React for frontend programming.

CO3: Construct a user interface with React and Material-UI.

CO4: Evaluate database application for its optimum performance.

CO5: Create a front end and back end using various tools and techniques.

Board of Studies (BoS) :
16th BoS of CA held on 23.12.2021

Academic Council:
18th AC held on 24.02.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H				M				L		M			H
CO2			M		M	H				M				M
CO3			L							L		L	M	
CO4	H	M							M					L
CO5		L								M		H		L

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Industry, Innovation & Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Designing and developing skills taught in this course with respect to the course outcomes improve the unique capabilities of the learner. It would create a variety of ways for the learner to progress and can help significantly improve the quality of the learner.

CADY 364   **DATA ANALYTICS AND VISUALIZATION**   **L   T   P   C**

SDG: 4   **3   0   0   3**

COURSE OBJECTIVES:

COB1: Summarize and present data in meaningful ways.

COB2: Select the appropriate clustering method depending on the data and information.

COB3: Analyze the concept of regression.

COB4: Understand and verify the underlying assumptions and analysis on labeled data.

COB5: Conduct, present, and interpret common statistical analyses using R with basic theory and practical implementation details to solve real world problems.

MODULE I   INTRODUCTION TO DATA AND MACHINE LEARNING   9

Importance of analytics and visualization with data abundance- Review of probability- statistics and random processes- Estimation theory- Machine learning- supervised and unsupervised learning- gradient descent- overfitting, regularization.

MODULE II   UNSUPERVISED LEARNING & EVALUATION METHODS   9

Clustering techniques: K-means, Gaussian mixture models and expectation-maximization- agglomerative clustering- evaluation of clustering- Rand index, mutual information based scores, Fowlkes-Mallows index.

MODULE III   SUPERVISED LEARNING & REGRESSION   9

Supervised classification methods: K-nearest neighbor- naive Bayes- logistic regression- decision tree- support vector machine- Introduction to artificial neural networks (ANNs)- Regression: Linear models- ordinary least squares- ridge regression- LASSO- Gaussian Processes regression.

MODULE IV   ANALYSING DATA   9

Normal distribution - Sampling - The Central Limit Theorem- One-Way Analysis of Variance - F-test for ANOVA - Evaluating Group Differences - Type I and Type II Errors- Issues with Multiple Comparisons Analysis for proportions- Analysis for proportions - Two-Sample Tests for Proportions.

MODULE V   DATA VISUALIZATION   9

Basic principles- categorical and continuous variables- exploratory graphical

analysis- Creating static graphs- animated visualizations- loops, GIFs and Videos- Data visualization in Python and R Programming- Data Structures and examples.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Nathan Yau, "Data Points: Visualization That Means Something", Wiley publications, 5 April 2013. (ISBN: 978-1-118-46219).
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 1st ed. 2006. (ISBN-13: 978-0387-31073-2).
3. Gabriel A. Canepa, "What you need to know about Machine Learning", September 2018.

REFERENCES:

1. Jaejin Hwang, Youngjin Yoon, "Data Analytics and Visualization in Quality Analysis using Tableau", published by Taylor & Francis Group, LLC, 2021.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'Reilly Media, 1st edition, 18 March 2019. (ISBN-10 : 1492031089)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, Inc., 2016. (ISBN: 9781491912058).

COURSE OUTCOMES:

CO1: The student will gain detailed knowledge about the goal and techniques of the data analysis and visualization process.

CO2: The student will be able to build models for data that has no labeled training data available: Unsupervised learning

CO3: Apply suitable machine learning and/or visualization techniques and analyze the results obtained to enable optimal decision-making.

CO4: The student will understand the steps in characterizing and understanding data and will be able to build effective predictive models.

CO5: The student will be able to use software applications and able to build models in R Programming.

Board of Studies (BoS) :   **Academic Council:**

15th BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		M				L								
CO2				M			M							
CO3		H						M						
CO4		H											L	
CO5			H						M					M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The understanding of using visualization and data analytics fosters continuous learning and sustainable quality education through programming language.

CADY 367   **R PROGRAMMING**   L   T   P   C

SDG: 9   3   0   0   3

COURSE OBJECTIVES:

  COB1: Understand the basics in R programming

  COB2: To know how R programming used for Big Data analytics

  COB3: To learn the need for Text Processing

  COB4: Understand and able to know the R programming from a
           statistical approach

  COB5: Learn and analyzing R with other languages

MODULE I   INTRODUCTION   9

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorized if-then else – Vector Equality – Vector Element names.

MODULE II   MATRICES, ARRAYS AND LISTS   9

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive list.

MODULE III   DATA FRAMES   9

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R.

MODULE IV   OBJECT ORIENTED PROGRAMMING IN R   9

S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving

graphs to files – Creating three-dimensional plots.

MODULE V   INTERFACING   9

      Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

L - 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.
2. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.

REFERENCES:

1. Mark Gardener, "Beginning R – The Statistical Programming Language", Wiley, 2013.
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc., 2013.

COURSE OUTCOMES:

CO1: Understand the basics in R programming in terms of constructs, control statements, string functions

CO2: Understand the use of R for Big Data analytics

CO3: Learn to apply R programming for Text processing

CO4: Able to appreciate and apply the R programming from a statistical perspective

CO5: Learn to make analysis with other languages

Board of Studies (BoS):   **Academic Council:**

15^h BoS of CA held on 22.06.2021   17th AC held on 14.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1													H	H
CO2	H	M												M
CO3		H					L	M						L
CO4	L													
CO5	L	M								H				M

  Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

In learning R Programming concepts, students will be able to adapt with cloud environment and to compare with other programming languages as like technical survey in their application development.