B.S. Abdur Rahman ™
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2022
Curriculum and Syllabi
(As approved by 22nd Academic Council - September 2024)

M.Tech.
(Computer Science and Engineering)

B.S. Abdur Rahman® Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2022
CURRICULUM AND SYLLABI
(As approved by the 22nd Academic Council)

SEPTEMBER – 2024

M.TECH.
COMPUTER SCIENCE AND ENGINEERING
(Integrated with LTIMindTree)
(with effect from academic year 2024-25)

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.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self-learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership.
- Skills in students through various co-curricular and extra – curricular activities.
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Computer Science and Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide advanced knowledge and skills in the field of Computer Science and Engineering.
- To provide essential skill sets needed for Software Development as per the Industry requirements.
- To instill confidence and provide necessary ambience to take up fundamental as well as applied Research in Computer related domains with social relevance.
- To impart required analytical skills and tools for solving problems with varied complexity.
- To hone necessary skills to effectively communicate, work as a team for a successful professional career.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES

PSO1 : Design, Analyze and develop essential proficiency in the areas related to algorithms, networking, web design, big data analytics, cloud computing, security, IoT and apply the knowledge to solve real world problems.

PSO2 : Apply the knowledge of computer science in various domains to identify research gaps and provide solutions in an optimized way.

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

REGULATIONS 2022

M.Tech. / MCA / M.Sc. / M.Com. / M.A. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means post graduate degree programme (M.Tech. / MCA / M.Sc. / M.Com. / M.A.)

ii) **"Branch"** means specialization or discipline of programme like M.Tech. in Structural Engineering, Food Biotechnology etc., M.Sc. in Physics, Chemistry, Actuarial Science, Biotechnology etc.

iii) **"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.

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

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.	
M.A.	

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 as specified in the clause 3.2 [Eligible entry qualifications for admission to programmes] of this Institution or any other University or authority accepted by this Institution.

2.2.2 The other 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	4	8
M.Sc.	4	8
M.Com.	4	8
M.A.	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	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
1.	Aeronautical Engineering	M.Tech. (Avionics)	B.E. / B.Tech. in Aeronautical Engineering / Aerospace Engineering / Mechanical Engineering / Mechatronics / EEE / ECE / EIE / or Equivalent degree in relevant field.
2.	Civil Engineering	M.Tech. (Structural Engineering)	B.E. / B.Tech. in Civil Engineering / Structural Engineering or Equivalent degree in relevant field.
		M. Tech. (Construction Engineering and Project Management)	B.E. / B.Tech. in Civil Engineering / Structural Engineering / B.Arch. or Equivalent degree in relevant field.
3.	Mechanical Engineering	M.Tech. (CAD/CAM)	B.E. / B.Tech. in Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Polymer / Plastics / Marine Engineering or Equivalent degree in relevant field.
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engineering)	B.E. / B.Tech. in EEE / ECE / EIE / ICE / Electronics / Instrumentation Engineering or Equivalent degree in relevant field.
5.	Electronics and Communication Engineering	M.Tech. (VLSI and Embedded Systems)	B.E. / B.Tech. in ECE / EIE / ICE / EEE / IT or Equivalent degree in relevant field.
6.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
7.	Information Technology	M.Tech. (Information Technology)	B.E. / B.Tech. in IT / CSE / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
8.	Computer Applications	MCA	BCA / B.Sc. Computer Science / B.E. / B.Tech. / B.Sc. Mathematics, B.Sc. Physics / Chemistry / B.Com. / BBA / B.A. with Mathematics at graduation level or at 10 + 2level or equivalent degree in relevant field.
9.	Mathematics	M.Sc. (Actuarial Science)	Any under graduate degree with Mathematics / Statistics as one of the subjects of study at 10 + 2 level.
10.	Physics	M.Sc. (Physics)	B.Sc. in Physics / Applied Science / Electronics /Electronics Science / Electronics & Instrumentation or Equivalent degree in relevant field.
11.	Chemistry	M.Sc.(Chemistry)	B.Sc. in Chemistry / Applied Science or Equivalent degree in relevant field.
12.	Life Sciences	M.Sc. Biochemistry & Molecular Biology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Biotechnology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Microbiology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Tech. Biotechnology	B.Tech. / B.E. in Biotechnology or Equivalent degree in relevant field.
		M.Tech. Food Biotechnology	B.E. / B.Tech. in Biotechnology / Food Biotechnology / Chemical Engineering / Biochemical Engineering / Industrial Biotechnology or Equivalent degree in relevant field.
13.	Commerce	M.Com	B.Com. / BBA
14.	Arabic and Islamic	M.A. Islamic Studies	B.A. in Islamic Studies / Arabic (or) Afzal-ul-Ulama (or)

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
	Studies		Any under graduate degree with Part 1 Arabic (or) Any under graduate degree with AalimSanad / Diploma / Certificate in Arabic or Islamic Studies.

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 integrated theory courses
iv. Project work
v. Laboratory courses
vi. Open elective courses
vii. Seminar
viii. Mini Project
ix. Industry Internship
x. MOOC courses (NPTEL-Swayam, Coursera etc.)
xi. Value added courses

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 credit 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.	76 -80
MCA	86
M.Sc.	77 - 85
M.Com.	88
M.A.	72

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

- ❖ Onecredit 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 160 hours of industry internship per semester for all programmes (except M.Com.)
- ❖ Four credits for 160 hours of industry internship per semester for M.Com.

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 32	18 to 26
MCA	9 to 32	18 to 26
M.Sc.	9 to 32	10 to 26
M.Com.	9 to 32	16 to 28
M.A.	9 to 32	NA

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, alter to open electives, during the entire period of study, with approval of 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 40% of credits of courses in a semester excluding

project semester (in case of M.Tech. M.Sc. & MCA programmes) 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 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 project supervisor.

3.5 PROJECT WORK

3.5.1 Project work 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 / Competent authority 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 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 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 class throughout their period of study.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students

shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

5.0 COURSE COMMITTEE

5.1 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.

6.0 CLASS COMMITTEE

6.1 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:

6.2 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

6.3 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 assessmentshall 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.

6.4 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 syllabi of courses.

6.5 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.

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. 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.

7.2 Change of a Course

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

7.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous 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 enroll for a maximum of 32 credits during a semester including Redo / Predo courses.

8.0 BREAK OF STUDY FROM PROGRAMME

8.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

8.1.1 Medical or other valid grounds

8.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

8.1.3 Debarred due to any act of indiscipline

8.2 The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

8.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

8.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT WORK

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	22
M.Sc.	18
M.Com	NA
M.A.	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 REQUIREMENT AND SEMESTER / COURSE REPETITION

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% 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.

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 the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

10.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

10.4 A student who has obtained an “I” grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat 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.

10.5 The student awarded “I” grade, shall enroll and repeat the course when it is offered next. In case of “I” grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

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

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

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the department concerned, based on the availability of faculty members, and subject to a specified minimum number of students registering for each of such courses.

11.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

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 Theory Course

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

12.3 Laboratory Course

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

12.4 Laboratory Integrated Theory Courses

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 components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

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

12.6 Industry Internship

In the case of industry internship, 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 / academic organization. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by the 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.

12.8 The assessment of seminar course including its component and its weightage shall be decided by a committee of faculty members constituted by the Head of the Department. This committee shall ensure the conduct of assessment of componentsand award marks accordingly.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination.

From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

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 examination for theory component. There shall be no arrear or improvement examination for lab components.

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 semesters.

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

preferably 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
I	0

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

"U" denotes unsuccessful performance in the course.

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 fees tothe 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 i^{th} course and GP_i is the Grade Point in the i^{th} course

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

Where n = number of courses

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

"I" grade is excluded for calculating GPA.

"U" and**"I"** 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

15.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the PG programme within the minimum prescribed period of study (except clause 8.1.1)

15.6.2 Eligibility for First Class

A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 8.1.1)

15.6.3 The students who do not satisfy clause 15.6.1 and clause 15.6.2 shall be classified as second class.

15.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

16.0 DISCIPLINE

16.1 Every student is expected to observe discipline and decorum 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 MASTER'S DEGREE

17.1 A student shall be declared to be eligible for the award of the Master's 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 AND TECHNOLOGY

M.TECH. COMPUTER SCIENCE AND ENGINEERING

(Integrated with LTIMind Tree)

(with effect from academic year 2024-25)

CURRICULUM & SYLLABUS, REGULATIONS 2022

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAE 6181	Applied Algebra and Discrete Algorithms	3	1	0	4
2	CSE 6102	Algorithm Design and Implementation	3	0	2	4
3	CSE 6151	Edge Engineering	3	1	0	4
4	CSE 6152	Programming for Data Analysis	3	0	0	3
5		Professional Elective – I	3	0	0	3
6	CSE 6153	Edge Engineering Lab	0	0	2	1
7	CSE 6154	Programming Lab	0	0	4	2
8	ENE 6181	English for Career Development	1	0	2	2
		Credits				**23**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	GEE 6201	Research Methodology and IPR	2	0	0	2
2	CSE 6201	Machine Learning Techniques	3	0	2	4
3	CSE 6203	Advanced Software Engineering and Agile Modeling	3	0	0	3
3	CSE 6161	IoT Middleware and Data Engineering	3	0	0	3
4		Professional Elective -II	3	0	0	3
5		Professional Electives -III	3	0	0	3
6	ENE 6281	Professional Skills	0	0	2	1
7	CSE 6162	IoT Middleware and Data Engineering Lab	0	0	2	1
8	CSE 6163	Embedded Programming Lab	0	0	2	1
		Credits				**21**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Professional Elective – IV	3	0	0	3
2.	CSE 7101	Industry Internship				3
3.	CSE 7102	Project Work - Phase I	0	0	0	9
4.		MOOC (Related to Project)				-
		Credits				**6**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	CSE 7102	Project Work - Phase II	0	0	0	12
		Credits				**9+12= 21**

Overall Total Credits– 71

* Industrial training will be under taken during first year summer vacation for 30 days. The credit will be awarded in the3rdSemester.

\# Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

LIST OF PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1.	CSEY 001	Cloud Computing and Technology	3	0	0	3
2.	CSEY 002	Pervasive Computing	3	0	0	3
3.	CSEY 003	Applied Cryptography and Network Security	3	0	0	3
4.	CSEY 004	Advanced Database Management	3	0	0	3
5.	CSEY 005	Advanced Data warehousing and Datamining	3	0	0	3
6.	CSEY 101	Java programming for IoT applications	3	0	0	3
7.	CSEY 102	.Net programming for IoT applications	3	0	0	3
		SEMESTER II				
1.	CSEY 006	Data Science with Python	3	0	0	3
2.	CSEY 007	Social Network Analysis and Mining	3	0	0	3
3.	CSEY 008	Security Issues in Cloud Computing	3	0	0	3
4.	CSEY 009	Advanced Software Quality Assurance	3	0	0	3
5.	CSEY 010	Bigdata Analytics and loT	3	0	0	3
6.	CSEY 011	Mobile Adhoc Networks	3	0	0	3
7.	CSEY 012	Information Security	3	0	0	3
8.	CSEY 013	RFID and Microcontroller	3	0	0	3
9.	CSEY 014	Mobile and Wireless Network Security	3	0	0	3
10.	CSEY 015	Cloud Architecture and Computing	3	0	0	3
11.	CSEY 016	Knowledge Engineering and Expert Systems	3	0	0	3
12.	CSEY 017	Agent-based Intelligent Systems	3	0	0	3
13.	CSEY 018	Deep Learning Techniques	3	0	0	3
14.	CSEY 019	Distributed Systems	3	0	0	3
15.	CSEY 020	Advanced Graph Theory	3	0	0	3
16.	CSEY 111	Application Architecture & Deployment	3	0	0	3
17.	CSEY 112	Embedded Programming	3	0	0	3

SEMESTER III

1.	CSEY 021	Statistics for Business Analytics	3	0	0	3
2.	CSEY 022	Computer Vision and Image Processing	3	0	0	3
3.	CSEY 023	Foundations of Block Chain Technology	3	0	0	3
4.	CSEY 024	Cyber laws and Intellectual Property Rights	3	0	0	3
5.	CSEY 025	Security of E-Based Systems	3	0	0	3
6.	CSEY 026	Advanced Software Project Management	3	0	0	3
7.	CSEY 027	Statistical Natural Language Processing	3	0	0	3
8.	CSEY 028	Robotics and Intelligent Systems	3	0	0	3
9.	CSEY 029	Intelligent Information Retrieval	3	0	0	3
10.	CSEY 030	Soft Computing	3	0	0	3
11.	CSEY 031	System Simulation and Modelling Techniques	3	0	0	3
12.	CSEY 032	Cellular Automata and its Applications	3	0	0	3
13.	CSEY 121	IOT industry best practices, standards and compliances	3	0	0	3

SEMESTER I

		L	T	P	C
MAE 6181	**APPLIED ALGEBRA AND DISCRETE**				
SDG: 9	**ALGORITHMS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: Make understand the concepts of mathematical induction and codes.

COB2: Motivate to solve the practical engineering problems applying techniques of logic.

COB3: To expose students to the concepts of Formal languages and Automata theory.

COB4: Familiarize students with graph theory.

COB5: Understand the basic foundation of Cryptography.

MODULE I INTEGERS, COMPUTER ALGEBRA AND CODES 9+3

Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, Octal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

MODULE II LOGIC 9+3

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – Nand, NOR – logic gates - solving word problems - predicate logic - universal and existential quantifiers - proof techniques – direct and indirect – proof by contradiction –applications.

MODULE III MODELING, COMPUTATION AND LANGUAGES 9+3

Finite state machines - deterministic and non-deterministic finite state machines - classes of grammars - phrase structure grammar - context sensitive - context-free - regular grammars - formal languages - ambiguity - Turing machines.

MODULE IV GRAPH THEORY 9+3

Multigraphs - applications of graph theory - classes of graphs - subgraphs and morphisms - Hamilton circuits – planar graphs – shortest paths and spanning trees – minimum spanning tree – fundamental cut sets and fundamental circuits - applications.

MODULE V CIPHERS 9+3

Cryptography - cryptanalysis - substitution and permutation ciphers – block cipher – the play fair cipher – hill cipher - unbreakable ciphers – applications.

L – 45; T – 15; TOTAL HOURS - 60

TEXT BOOKS:

1. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers, and Discrete Algorithms, 2nd edition, CRC Press, Newyork, 2009.
2. Hopcraft, J. E, R. Motwani and Ullman, J. D, 'Introduction to Automata theory, Languages and Computation', Narosa publishing House, 4th edition 2006.
3. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2015.
4. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.

REFERENCES:

1. JurajHromkovic, Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication and Cryptography, Springer, 2003.
2. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers and Discrete Algorithms, Second Edition (Discrete Mathematics and Its Applications), CRC Press, Newyork, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, Edition 3,1993.

COURSE OUTCOMES:

CO1: Authenticate the correctness of a given statement using mathematical induction.

CO2: Test and analyze the logic of a program

CO3: Use the concept of finite state machines in their courses and to generate languages.

CO4: Solve problems in engineering using the concepts of graph theory.

CO5: Apply encryption and decryption techniques to send messages securely.

Board of Studies(BoS):	**Academic Council:**
20th BoS of Department of CSE held on 16.08.2022	19th Academic Council held on 29.09.2022

	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	L												L	
CO2		L											L	
CO3		M												M
CO4			M										M	
CO5				M										M

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

SDG 9: Sustainable Industry, innovation and Infrastructure.

Statement: Learning of various techniques in applied algebra and discrete algorithms will lead to knowledge required for applying in Computer Science projects.

CSE 6102	ALGORITHM DESIGN AND	L T P C
SDG: 8	IMPLEMENTATION	3 0 2 4

COURSE OBJECTIVES:

COB1: To discuss various algorithm design techniques for developing algorithms.

COB2: To study the basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.

COB3: To provide the basic knowledge of computational complexity, approximation and randomized algorithms.

COB4: To Learn the advanced techniques for designing algorithms, including dynamic programming, network flow and problem reduction.

COB5: To determine the time and space complexity of simple algorithms and recursively defined algorithms.

MODULEI INTRODUCTION 9

Introduction and Motivation-Lower Bound-Asymptotic Notations-Mathematical Induction-Mathematical Models-Formulating the Equations-Solving the equations-Homogeneous Linear Recurrence with Constant Coefficients-Non-homogeneous Equations-Transformations.

MODULE II GRAPH ALGORITHMS 9

Elementary Graph Algorithms Breadth-first search – Depth-first search - Topological sort- Minimum Spanning Trees -The algorithms of Kruskal and Prim – Single-Source Shortest Paths - The Bellman-Ford algorithm – Single-source shortest paths in directed acyclic graphs -Dijkstra's algorithm – All-Pairs Shortest Paths -The Floyd-Warshall algorithm -Johnson's algorithm for sparse graphs- Maximum Flow- Flow network- The Ford-Fulkerson method- Maximum bipartite matching-Push-relabel algorithms-The relabel-to-front algorithm.

MODULE III DIVIDE-AND-CONQUERANDRANDOMIZED ALGORITHMS 9

The maximum-sub array problem- Strassen's algorithm for matrix multiplication- The substitution method for solving recurrences-The recursion-tree method for solving recurrences-The master method for solving recurrences-Proof of the master theorem-The hiring problem- Indicator random variables-Randomized Algorithms-Probabilistic analysis and further uses of indicator random variables.

MODULE IV MULTITHREADED AND NUMBER - THEORETIC ALGORITHMS **9**

The basics of dynamic multithreading-Multithreaded matrix multiplication -Multithreaded merge sort-Elementary number-theoretic notions- Greatest common divisor -Modular arithmetic -Solving modular linear equations - The Chinese remainder theorem - Powers of an element- The RSA public-key cryptosystem- Primality testing-Integer factorization.

MODULE V NP - COMPLETENESS AND APPROXIMATION ALGORITHMS **9**

Polynomial time - Polynomial - time verification-NP-completeness and reducibility-NP-completeness proofs-NP-complete problems. Approximation Algorithms**-**The vertex-cover problem-The traveling-salesman problem-The set-covering problem-Randomization and linear programming-The subset-sum problem.

L – 45; P - 30; TOTAL HOURS – 75

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd Edition MIT Press, 978-0262033848,2009.
2. Robert Sedgewick, Kevin Wayne, “Algorithms”, 4th Edition, Addison Wesley, ISBN-13: 978-0321573513, 2011.
3. Alfred V Aho, John E Hopcrof,” The Design and Analysis of Computer Algorithms”, Pearon Education,4th Edition, ISBN:978813170205,2009.
4. Mark Allen Weiss,” Data Structures and Algorithm Analysis in C++”, Addison-Wesley, 3rd edition, ISBN: 978-0132847377,2013.

COURSE OUTCOMES:

CO1: Analyze randomized algorithms with respect to expected running time, probability of error using tail inequalities

CO2: Classify problems into different complexity classes corresponding to both deterministic and randomized algorithms

CO3: Analyze approximation algorithms including algorithms that are PTAS and FPTAS.

CO4: Implement both a greedy and a divide-and-conquer algorithm to solve problems.

CO5: Design the techniques of proof by contradiction, mathematical induction and recurrence relation, and apply them to prove the correctness and to analyze the running time of algorithms.

Board of Studies(BoS):	**Academic Council:**
20th BoS of Department of CSE held on 16.08.2022	19th Academic Council held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	M												M	
CO2			M											M
CO3				M									H	
CO4			M										M	
CO5		H												M

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: By learning Algorithm design, students can apply algorithms in order to take actions in complex decision-making environment, which in turn leads to sustainable economic growth and enormous employment opportunities.

CSE 6151 EDGE ENGINEERING L T P C

3 1 0 4

COURSE OBJECTIVES:

COB1: To highlight the basic concepts of network types, models and security.

COB2: To learn about different IoT sensors and actuators.

COB3: To understand IoT connectivity and communication technologies, communication protocols and industry standard protocols.

COB4: To introduce a programming platform for communication between edge devices and cloud.

COB5: To explore the IoT applications and futuristic trends in market.

MODULE I NETWORKING 12

Introduction to IoT; Network Types: Connection types - Physical topology - Network reachability; Layered Network Models: OSI Model - Internet protocol suite; TCP/IP Transport layer: Connectionless service - Connection-oriented service; Basics of Network Security: Introduction – Security - Symmetric key cryptography - Asymmetric key cryptography - Message Integrity and Authenticity - Digital signatures - Internet Security - Network layer security - Application layer security- Firewall; Predecessors of IoT: Wireless Sensor Networks - Architectural components of WSN - Machine-to-Machine Communications - Architectural components of M2M- Cyber Physical Systems.

MODULE II IOT SENSORS AND PROCESSING 12

Emergence of IoT: IoT versus M2M - IoT versus WoT - Enabling IoT and the Complex Interdependence of Technologies - IoT Networking Components - Addressing Strategies in IoT - Address management classes - Addressing during node mobility; IoT Sensing and Actuation: Introduction – Sensors - Sensor Characteristics - Sensorial Deviations- Sensing Types - Scalar sensing - Virtual sensing - Sensing Considerations - Actuator Types - Hydraulic actuators - Pneumatic actuators - Electric actuators - Thermal or magnetic actuators - Mechanical actuators - Soft actuators - Shape memory polymers - Actuator Characteristics; IoT Processing Topologies and Types: Data Format - Structured data - Unstructured data - Importance of Processing in IoT - Processing Topologies - On-site processing - IoT Device Design and Selection Considerations

MODULE III IOT CONNECTIVITY AND COMMUNICATION 12

IoT Connectivity Technologies: Introduction - IEEE 802.15.4 – Zigbee- Thread – Wireless HART – RFID – NFC - Z-Wave – Weightless – Sigfox – LoRa - NB-IoT - Wi-Fi – Bluetooth; IoT Communication Technologies: Introduction - Constrained nodes - Constrained networks - Types of constrained devices - Low power and lossy networks - Infrastructure Protocols - Internet protocol version 6 (IPv6) - Data Protocols – MQTT - MQTT-SN – CoAP- AMQP – XMPP – REST – WebSocket Device Management; Serial Communication Protocol: UART - I2C – SPI; Industrial Protocols: Modbus – Profibus – BACnet.

MODULE IV PROGRAMMING EDGE AND CLOUD EDGE GATEWAY 12

Programming Edge Devices: Introduction to C - Introduction to Arduino Programming - Sensors and Actuators integration to Arduino - Introduction to Python Programming - Introduction to RaspberryPi - Sensors and Actuators integration to RaspberryPi - Implementation of IoT on Raspberrypi; Cloud Edge gateway Design & Programming: Azure edge gateway - Design & Implementation - Simulation of device data with program and usage of edge as buffer/local storage - Usage of Azure SQL & blob edge - Deployment of edge in Kubernetes - AKRI and Edge essentials - Scalability and high availability of edge gateway - Project assignment- AWS edge gateway - Design & Implementation- Simulation of device data with program and usage of edge as buffer/local storage - AWS Greengrass & IoTSitewise - Deployment of edge in Kubernetes - Scalability and high availability of edge gateway - Project assignment - Build Azure/AWS edge connecting to physical device which will be designed in lab or simulated device.

MODULE V IOT APPLICATIONS 12

IoT Case Studies & Future Trends: Agricultural IoT - Components of an agricultural IoT - Advantages of IoT in agriculture - Vehicular IoT - Components of vehicular IoT - Advantages of vehicular IoT - Healthcare IoT - Components of healthcare IoT - Advantages and risk of healthcare IoT.

L – 45; T- 15; TOTAL HOURS – 60

REFERENCES:

1. AK Dubey, Vijayan Sugumaran, Peter Han Joo Chong (2023), Advanced IoT Sensors, Networks and Systems, Springer.
2. C. Santhiya and S. Padmavathi (2023), Perspective Chapter: A View – Cloud-Edge Computing Technology.
3. Gerardus Blokdyk (2008), IoT Communication Protocols Second Edition, 5STARCooks.

COURSEOUTCOMES:

Students who complete this course will be able to

CO1: Describe the network types, models and security.
CO2: Identify the suitable IoT sensors and actuators for real time applications.
CO3: Write programs for IoT connectivity and communication technologies using communication protocols and industry standard protocols.
CO4: Design a program for edge devices and develop cloud edge gateways.
CO5: Implement IoT applications and futuristic trends in market.

Board of Studies (BoS): 23rd BoS of CSE held on 02.09.2024

Academic Council: 22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H		L									M	H	
CO2	H		H						H			L	H	
CO3	H			H	H					M			M	
CO4		M		H		M					M			H
CO5			H		H		M	M			H			M

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work in IoT based industry by learning Edge Engineering.

CSE 6152 PROGRAMMING FOR DATA ANALYSIS L T P C

3 0 0 3

COURSEOBJECTIVES:

COB1: To learn the fundamentals of Big Data.

COB2: To get familiar with the NoSQL and Processing tools.

COB3: To learn advanced concepts of Spark code in depth.

COB4: To provide the methods of developing the Pyspark programs using RDD

COB5: To develop a project on Pyspark programs.

MODULE I INTRODUCTION TO BIG DATA 9

Definition of Big data - Relational databases - Structured, Unstructured and semi-structured data - Big data tooling and technology - Scale up vs Scale out.

MODULE II NoSQL AND PROCESSING TOOLS 9

NoSQL, Key-value stores, column-oriented stores - Document stores, Graph stores - Basics of Map Reduce - What is Spark, Spark batch, Spark Streaming, Storm - Supportive Operational tools.

MODULE III SPARK CORE IN DEPTH 9

Big data ecosystem- RDD (Resilient Distributed Datasets) - Resource Managers - YARN, standalone mode - Deep dive - Spark internals - Accumulators, Broadcast variables - Spark streaming - Spark SQL and Data frames - Machine Learning (NLP, k-means clustering, PageRank, Shortest Path) – Graph Frames - Visualizations (Matplotlib, Google Charts, D3.js) - Advanced Performance Tuning and Debugging- Spark UI.

MODULE IV PYSPARK - PROGRAMMING 9

PySpark coding using RDD - PySpark coding using Data Frames - Semi structured file data analysis - Structured file data analysis - Unstructured file data analysis - Distributed processing challenges - Spark performance tuning - Lazy evaluation - Spark internal execution - step by step - Spark SQL using JDBC.

MODULE V CODE WITH US 9

Project

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Tomasz Drabas, Denny Lee (2017), Learning PySpark, Packt Publishing.
2. Pedro Duarte Faria (2024), Introduction to PySpark, independently published

3. Matei Zaharia, Bill Chambers (2018), Spark: The Definitive Guide - Big Data Processing Made Simple (Greyscale Indian Edition), Shroff/O'Reilly.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Perform data analysis for structured, unstructured and semi-structured data sources.

CO2: Implement a model that combines NoSQL databases, Map Reduce, Spark, and operational tools in big data applications.

CO3: Demonstrate spark code in depth on RDD, spark internals, Data frames, visualizations and usage of Spark UI

CO4: Develop Pyspark programs using RDD and data frames.

CO5: Implement real time project in spark SQL using JDBC.

Board of Studies (BoS): 23rd BoS of CSE held on 02.09.2024

Academic Council: 22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		M	M						L				M	H
CO2	M					M							H	M
CO3		H						M					M	
CO4			M			M								
CO5		L	M		L				H		M			M

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning the Programming for Data Analysis course.

CSE 6153	EDGE ENGINEERING LAB	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

COB1: To understand the functional components of raspberry Pi device.

COB2: To introduce the programming features of AWS and Azure IoT.

COB3: To get familiar with the services of Power BI.

COB4: To learn installation and working procedures of Azure/AWS platform.

COB5: To explore the IoT applications using Azure/AWS services.

LIST OF EXPERIMENTS

1. Consider raspberry Pi and write python language to capture the real time data from sensors and send it to AWS IoT Core.
2. Consider raspberry Pi and write python language to capture the real time data from sensors and send it to Azure IoT hub.
3. Create asset utilization dashboard in Power BI with real time data simulated from sensors and generate actions with cloud specific services.
4. Create azure edge by installing azure edge runtime in Azure VM, write python simulator to generate device data and use Grafana dashboard to create real time monitoring insights.
5. Create AWS green grass edge run time and use awsiotsitewise edge to transfer the simulated device data to AWS IoT Core and generate real time insights using grafana dashboard.
6. Create an application to implement protocol translation in edge.
7. Simulate device data with python program in edge VM and implement local storage in edge using either Azure/AWS Services.
8. Implement Smart lightning use case with sensor data transferred from edge in Azure to Azure IoT hub and creation of grafana dashboards for real time insights with 10 KPIs. Find the right sensor for smart lightning and build small model, showcase working solution by designing edge in Azure and real time insight generation using Azure IoT hub, ADLS gen2 and PowerBi/Grafana.

P- 30; TOTAL HOURS – 30

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Capture real time data using raspberry PI.

CO2: Communicate real time data to AWS and Azure cloud services.

CO3: Connect, visualize and analyze real time data set using Power BI

CO4: Design a system level programming that run on edge devices and s.

CO5: Develop cloud edge gateway for communication between edge and cloud platform.

Board of Studies (BoS): 23rd BoS of CSE held on 02.09.2024

Academic Council: 22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	H	H	L									M	H	
CO2	H	H	H	H	H				H	H	H	L	H	H
CO3	H	H	H	H	H				H	H	H		H	H
CO4	H	H	H	H	H	M	M		H	H	H		H	H
CO5	H	H	H	H	H	M	M	M	H	H	H		H	H

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work in IoT based industry by learning programming in edge engineering.

CSE 6154	PROGRAMMING LAB	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

COB1: To understand the basic concepts of OOPS.

COB2: Toget familiar with database connectivity using JDBC with MySQL.

COB3:. Toacquire the programming features of AWS and Azure IoT.

COB4: To learn deployment of .Net application to Azure using Azure DevOps.

COB5: To explore the data transformations in PySpark with Dataframes using different spark methods and functions.

LIST OF EXPERIMENTS

1. Implement Library management system utilizing all features of Java.
2. Implement OOPs concepts.
3. Implement Generics, exception handling.
4. Implement file handling I/O and serialization.
5. Implement database connectivity using JDBC with MySQL.
6. Implement APIs using all the concepts learnt.
7. Deploy Java application to Azure using Azure DevOps.
8. Implement Library management system utilizing all features of .NET.
9. Implement OOPs concepts.
10. Implement Generics, exception handling.
11. Implement file handling I/O and serialization.
12. Implement database connectivity using JDBC with MySQL.
13. Implement APIs using all the concepts learnt.
14. Deploy the .Net application to Azure using Azure DevOps to Azure App service.
15. Implement data transformations in PySpark with Dataframes using different spark methods and functions.
16. Use semi structured dataset stored in Data Lake either in json/parquet format, implement and showcase data analysis using PySpark scripts.
17. Create visualization using Matplotlib for the semi structured dataset.
18. Implement simple algorithm with publicly available data set and spark ML libraries, visualize and show the results.
19. Implement real time analytics using spark streaming libraries.

P- 60; TOTAL HOURS – 60

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Apply OOPs basic concepts to implement Java programs.

CO2:. Implement database connectivity using JDBC with MySQL.

CO3: Deploy the .Net application to Azure using Azure DevOps.

CO4: Design data transformations in PySpark with Dataframes using different spark methods and functions.

CO5: Develop real time analytics using spark streaming libraries.

Board of Studies (BoS):
23rd BoS of CSE held on 02.09.2024

Academic Council:
22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		M	M						L				M	H
CO2	M					M							H	M
CO3		H						M					M	
CO4			M			M								M
CO5		L	M		L				H		M			M

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The students will have productive employment by learning .NET programming and will be able to develop PySpark with data frames using different spark methods and functions

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ENE 6181	ENGLISH FOR CAREER DEVELOPMENT	L	T	P	C
SDG: 4 and 8		1	0	2	2

COURSE OBJECTIVES:

COB1: To enable students to learn about the job search, application, and interview process

COB2: To give them an opportunity to explore their global career path, build vocabulary and improve language skills to achieve professional goals

COB3: To produce a professional-looking resume

COB4: To understand networking and interview skills

COB5: To understand the key skills and behaviours required to facilitate a group discussion

MODULE I ENTERING THE JOB MARKET 3+6

(This module focuses more on the practical aspects of communication for career development.)

Introduction to the Career Development - Job Search Overview - Identifying Your Interests and Skills

Language Focus: Vocabulary and Word Forms Related to Jobs - Choosing the Job that's the Best Fit

Language Focus: Verb Tenses (Present vs. Present Progressive)

Understanding Job Descriptions: Reading a Job Advertisement

Language Focus: Phrases to Compare Similarities

Online Learning Opportunities to Extend Your Skills

MODULE II RESUMES 3+2

What is a resume? Why do you need one?

Parts of a Resume-Writing a Resume, Part 1: Name and Contact Information

Listening: Connecting Employers with Job Seekers in Today's Economy

Language Focus: Key Words

Writing a Resume, Part 2: Headline and Summary

Writing a Resume, Part 3: Work Experience

Writing a Resume, Part 4: Education

Language Focus: Action Verbs

Writing a Resume, Part 5: Complete your Resume

MODULE III WRITING A COVER LETTER 3+2

What is a Cover Letter?

Professional Writing: Letter Format

Cover Letter: Paragraph 1- Introducing Yourself

Cover Letter: Paragraph 2- Highlighting Your Skills in the Cover letter
Cover Letter: Paragraph 3- Closing
Language Focus – Present Perfect vs. Past Tense
Professional Writing: Level of Formality
Language Focus: Using Modal Verbs to Write politely
Writing a Cover Letter for a Specific Job

MODULE IV INTERVIEWING FOR A JOB 3+10

(This module focuses more on the practical aspects of communication for career development.)
Overview of the Job Interview: Answering Typical Interview Questions
Language Focus: Asking for Clarification in an Interview-
Sample Interview: Do's and Don'ts Part 1
Sample Interview: Do's and Don'ts Part 2
Sample Video: Responding to an Interview Question

MODULE V GROUP DISCUSSION 3+10

(This module focuses more on the practical aspects of communication for career development.)
Introduction to Group Discussion - Participating in group discussions – understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies - activities to improve GD skills

L-15, P-30; TOTAL HOURS - 45

REFERENCES:

1. R. Byrne, D. *Teaching Oral Skill.* London: Longman. 1975.
2. Byrne, D. *Teaching Writing*, London: Longman. 1975.
3. Rani Asoka, Devi Vimala. *English for Career development: A Course in Functional English.* Orient Longman Pvt. Ltd., India, 2004.
4. Anderson, K., Maclean, J. & Lynch, T. *Study speaking: A Course in Spoken English for Academic Purposes*. Cambridge University Press, UK, 2004.
5. Withrow, J., Brookes, G. & Cummings, M.C. *Inspired to write. Reading and Tasks to Develop Writing Skills*. Cambridge University Press, U.K., 2004.

COURSE OUTCOMES:

CO1: Identify the steps in the job search process

CO2: Describe themselves and their experiences in a résumé

CO3: Build their job-related vocabulary

CO4: Write a clear cover letter that tells employers why they are the right person for the job

CO5: Take part in Group discussion confidently.

Board of Studies (BoS) :	**Academic Council:**
15th BoS of the Department of English held on 14.6.2022	19th Meeting of the Academic Council held on 29.09.2022

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: This course ensures that the students acquire quality education and are also made eligible to obtain productive and decent employment.

PROGRAMME ELECTIVE I

CSEY 001	CLOUD COMPUTING ANDTECHNOLOGY	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To gain understanding of the basic concepts of cloud computing.

COB2: To learn various types of cloud services, technologies and service providers.

COB3: To gain the knowledge about different programming models and cloud software.

COB4: To understand the privacy and security issues in cloud environments.

COB5: To illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon.

MODULE I CLOUD COMPUTING BASICS 9

Introduction to Cloud Computing – Cloud computing reference model- Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -Cloud computing vendors.

MODULE II CLOUD COMPUTING TECHNOLOGY 8

Virtualization-Types of Virtualizations-Virtualizations and cloud computing-Clientthin, thick, mobile clients- Cloud Providers and Consumers-Various Cloud Services- Accessing the Cloud- Frameworks- Web Hosting Services- Web Applications- Web API"s and Web Browsers.

MODULE III CLOUD INFRASTRUCTURE 10

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development– Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE IV PROGRAMMING MODEL 10

Map Reduce programming model - Map reduce and extensions - Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - GFS and HDFS –Cloud platforms in Industry – Google App Engine, Amazon AWS- Cloud Software Environments -Eucalyptus, Open Nebula.

MODULE V SECURITY IN CLOUD 8

Cloud security fundamentals- Privacy and Security in cloud - Software-as-aService Security Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, McGraw-Hill,2010.
2. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd., 2013.
3. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
4. RajkumarBuyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc Publications, 2011.
5. Tim Malhar, S.Kumaraswammy, ShahedLatif, “Cloud Security & Privacy”, O‟Reilly media, 2009.

COURSE OUTCOMES:

CO1: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2: Identify the architecture, infrastructure and delivery models of cloud computing.

CO3: Discuss the cloud technologies including virtualization and web based technologies.

CO4: Work with online cloud services and collaborate with online documents and web-based applications.

CO5: Explain the core issues of cloud computing such as security, privacy and interoperability.

Board of Studies(BoS):
20th BoS of Department of CSE held on 16.08.2022

Academic Council:
19th Academic Council held on 29.09.2022

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

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning “Cloud Computing and Technology”, the students will be able to discuss economic models and future visions of economy and society critically and to communicate them in public spheres.

CSEY 002	PERVASIVE COMPUTING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the relationship, basic concepts and structures in pervasive computing.

COB2: To learn about Human-Computer Interface and Mobile Transactions in pervasive computing environment.

COB3: To highlight the role of sensor networks, wireless protocols in the design of pervasive applications.

COB4: To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area.

COB5: To design successful mobile and pervasive computing applications and services.

MODULE I BASIC CONCEPTS AND STRUCTURE 9

Relationship of Wireless Computing - Ubiquitous Computing - Internet Computing –Perspectives of pervasive computing – Challenges – Technology – Infrastructure and Devices – Middleware for Pervasive Computing Systems: Resource Management – User Tracking – Context Management – Service Management – Data Management – Security Management–Pervasive Computing Environments.

MODULE II CONTEXT COLLECTION AND RESOURCE MANAGEMENT 9

Context Collection and Wireless Sensor Networks – User Tracking – Context Reasoning: Evidence Theory – DSCR Model – Propagating Evidence in Sensors Layer and Object Layer – Recognizing User Activity – Evidence Selection Strategy – Performance – Resource Management in Pervasive Computing: Efficient Resource location – Transparent Task Migration.

MODULE III HUMAN-COMPUTER INTERFACE AND MOBILE TRANSACTIONS 9

Overview –HCI Service and Interaction Migration – Context-Driven HCI Service Selection – A web service-based HCI Migration Framework – Mobile Transaction Framework – Context-aware Pervasive Transaction model –Dynamic Transaction Management – Format Transaction Verification.

MODULE IV LOCAL AND WIDE AREA TECHNOLOGIES 9

Local area wireless networks: IEEE 802.11 technologies - Mobile IP- Infrared technologies. Bluetooth networks (OBEX Protocol) - Messaging Systems - Personal Area Networks - Network Management - Quality of Service - Wireless protocols - Establishing Wide area wireless networks: Concept and structure of "cell"- Call establishment and maintenance.

MODULE V PROTOCOLS 9

Protocols: Networking protocols - Packet switched protocols - Routing Protocols for Sensor Networks - Data Centric Protocols - Hierarchical Protocols Location-based protocols - Multimedia Messaging Service (MMS) Protocols Wireless Application Protocol (WAP)- Applications: Mobile access to patient information in a hospital, sales support, retailing.

L – 45; TOTAL HOURS –45

REFERENCES:

1. MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, "Pervasive Computing Concepts,Technologies and Applications", 1st Edition, CRC Press, 2016.
2. CiprianDobre and FatosXhafa, "Pervasive Computing-Next Generation Platforms for Intelligent Data Collection", 1st Edition, Elsevier Publication, 2016. ISBN:978-0-12-803663-1.
3. Natalia Silvis-Cividjian, "Pervasive Computing: Engineering Smart Systems", Springer Publishing, 2017. ISBN: 978-3-319-51655-4.

COURSE OUTCOMES:

CO1: Analyze the pervasive computing from normal computing applications.

CO2: Describe how the devices (sensors and RFIDs) operate in a pervasive computing environment.

CO3: Analyze the performance of different sensor data management and routing algorithms for sensor networks.

CO4: Apply the basic techniques, algorithms, protocols of different types of networks for designing pervasive computing system.

CO5: Identify the performance of various data dissemination techniques for mobile real-time applications.

Board of Studies(BoS):	**Academic Council:**
20th BoS of Department of CSE held on 16.08.2022	19th Academic Council held on 29.09.2022

	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	L												L	
CO2		L												L
CO3			M										M	
CO4				L										
CO5		M												M

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

SDG: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning “Pervasive Computing”, the students will be able to discuss economic models and future visions of economy and society critically and to communicate them in public spheres.

CSEY 003	APPLIED CRYPTOGRAPHY AND	L	T	P	C
SDG: 4	NETWORK SECURITY	3	0	0	3

COURSE OBJECTIVES:

COB1: Tohave a theoretical understanding of the principles underlying cryptography and cryptanalysis.

COB2: To have a fundamental understanding of symmetric and asymmetric encryption, hashing, and digital signatures.

COB3: To learn the basic concepts in networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security.

COB4: To become familiar with the cryptographic techniques that provide information and network security.

COB5: To be able to evaluate the security of communication systems, networks and protocols based on a multitude of security metrics.

MODULE I CRYPTOGRAPHY AND ENCRYPTION TECHNIQUES **9**

Overview – Principles-Concepts –Symmetric and Asymmetric Encryption– AES – Block Cipher Operations– RSA Algorithm – Diffie Hellman Key Exchange.

MODULE II DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST **10**

Hash Functions – SHA – Message Authentication Codes – Digital Signatures- Key Management and Distribution – X.509 Certificates – Kerberos.

MODULE III NETWORK SECURITY **8**

Vulnerabilities - Security Assessment, Analysis, and Assurance-Disaster Management – Access Control and Authentication – Authorization.

MODULE IV WIRELESS NETWORK SECURITY **8**

Wireless Security – Wireless LAN - Smart Phones – PDA – Bluetooth- Broadband Security.

MODULE V SECURITY IN EMERGING TECHNOLOGIES **9**

Next Generation Mobile Networks – Wireless Sensor Networks – Adhoc Networks – IP based Mobile Networks.

L – 45; TOTAL HOURS –45

REFERENCES:

1. William Stallings, “Cryptography and Network Security – Principles and Practice” 7th Edition, Pearson Education, ISBN No. 978-0134444284,2016.
2. Joseph MiggaKizza, “Guide to Computer Network Security” 3rd Edition, Springer Publishers, ISBN No 978-1447166535,2015.
3. Wolfgang Osterhage, “Wireless Security”, CRC Press, ISBN No. 978-1578087686,2011.
4. William Stallings, “Network Security Essentials, Applications and Standards”,5th Edition, Pearson Education, ISBN No.978-0133370430,2013.
5. John R.Vacca , “Network and System Security”,2nd Edition, Elsevier Publishers, ISBN No.978-0124166899,2014.

COURSE OUTCOMES:

CO1: have a technical understanding of the main cryptographic concepts and technologies available today.

CO2: understand the requirements and techniques for security management, including security policies, risk analysis, and physical threats and controls.

CO3: illustrate how cryptography and its application can maintain privacy and security in electronic communications and computer networks.

CO4: describe the vulnerabilities brought about by modern web-based application and services, and discuss countermeasures.

CO5: innovate techniques for enforcing computer and network security and developing secure e-commerce protocols.

Board of Studies(BoS):
20th BoS of Department of CSE held on 16.08.2022

Academic Council:
19th Academic Council held on 29.09.2022

	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		L												
CO2		L												
CO3	M													
CO4			M											
CO5				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.

Statement: The students will play a key role in cryptography network algorithms and societal progress through research, discovery, knowledge creation and dissemination. They educate and equip young people with the knowledge, acquired by building various application models.

CSEY 004	ADVANCED DATABASE	L	T	P	C
SDG: 9	MANAGEMENT	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn about design of databases.

COB2: Toattain knowledge on parallel and distributed databases and their applications.

COB3: Toconquer information on object and deductive databases.

COB4: Tolearn intelligent databases and various data models.

COB5: Toacquire data mining and data warehousing concepts.

MODULE I DISTRIBUTED & PARELLEL DATABASES **9**

Introduction to Distributed Databases – Types of Distributed Databases – Distributed DBMS Architectures –Storing Data in a Distributed DBMS – Distributed Catalog Management –Distributed Query Processing –Updating Distributed Data – Distributed Transactions – Distributed Concurrency Control –Distributed Recovery – Architectures for Parallel Databases – Parallel Query Evaluation – Parallelizing Individual Operations –Parallel Query Optimization.

MODULE II OBJECT & DEDUCTIVE DATABASES **9**

Structured Data Types – Operations on Structured Data – Encapsulation and ADTs – Objects, aIDs, and Reference Types – Database Design for an ORDBMS –ORDBMS Implementation Challenges – OODBMS – Comparing RDBMS, OODBMS, and ORDBMS: Deductive Databases: Introduction to Recursive Queries – Theoretical Foundations – Recursive Queries with Negation – Evaluating Recursive Queries.

MODULE III SPATIAL DATA MANAGEMENT & ENHANCED DATA MODELS **9**

Types of Spatial Data and Queries – Applications Involving Spatial Data – Introduction to Spatial Indexes, – Indexing Based on Space – Filling Curves – Grid Files – R Trees – Point and Region Data: Active Database concepts and triggers –Temporal Database concepts – Spatial Database concepts – Multimedia database concepts.

MODULE IV NOSQL IN DATABASE MANAGEMENT **9**

Introduction, Big Data, Scalability, Key/Value Stores, Hello NoSQL: Getting Initial Hands-On Experience, Working with Language Bindings, MongoDB's

Drivers, Interfacing And Interacting With NoSQL, Storing and Accessing Data, Storing Data In and Accessing Data from MongoDB, Querying MongoDB, Storing Data In and Accessing Data from Redis.

MODULE V DATABASES & DATA MINING 9

Active Databases – Syntax and Semantics of Active Databases –Application of Active Databases – Design Principles for Active Rules – Temporal Databases – Time Domain – Time Data types – Associating Facts with time – Overview of Data mining technology – Association rules – Classification – Clustering – Data mining techniques – Data mining process – Data mining tools.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004.
2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, - Database System Concepts‖, Sixth Edition, McGraw Hill, 2011.
3. RamezElmasri, Shamkant B. Navathe, - Fundamentals of Database Systems‖, Sixth Edition, Pearson, 2011
4. Thomas Cannolly and Carolyn Begg, - Database Systems, A Practical Approach to Design, Implementation and Management‖, Fourth Edition, Pearson Education, 2008.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, - An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, -Advanced Database Systems‖, Morgan Kaufmann publishers,2006.

COURSE OUTCOMES:

CO1: Develop in-depth understanding of parallel and distributed databases and to optimize database performance.

CO2: Attain and evaluate on each type of databases.

CO3: Learn database models for practical database problems.

CO4: Exposure to learn concepts and design of Data warehouse

CO5: Ability to solve real time problems using various databases.

Board of Studies(BoS):
20th BoS of Department of CSE held on 16.08.2022

Academic Council:
19th Academic Council held on 29.09.2022

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

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

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

Statement: To comprehend and evaluate the role of database management systems, with an emphasis on how to organize, maintain and retrieve information from a DBMS efficiently, and effectively in information technology applications within organizations.

CSEY 005	ADVANCED DATA WAREHOUSING	L	T	P	C
SDG: 9	AND DATA MINING	3	0	0	3

COURSE OBJECTIVES:

COB1: To provide students with basic knowledge of tools used for data mining.

COB2: To explore the technologies for storing and mining large databases.

COB3: To assess the concepts and methods used for mining the data.

COB4: To explore the strength and weakness of data mining algorithms.

COB5: To explain the application of data warehousing and data mining in real time scenario.

MODULE I DATA WAREHOUSING 8

Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

MODULE II DATA MINING TOOLS 9

Introduction to Data Mining Tools – Weka, R – Preparing Data Set – Working with Data Set – Data Preprocessing – Need for Data Preprocessing – Data Preprocessing Methods – Data Cleaning – Data Integration- Data Transformation – Data Reduction.

MODULE III CLASSIFICATION AND CLUSTERING 11

Introduction – Types of Classification- Input and Output Attributes – Guidelines – Size and Quality of Training data set – Decision Tree Classifier – Naïve Bayes Method – Metrics – Quality of Classifiers – Applications of Cluster Analysis – Desired Features of Clustering – Distance Metrics – Clustering Algorithms – Partitioning Clustering – Hierarchical Clustering Algorithms.

MODULE IV ASSOCIATION MINING AND WEB MINING 8

Introduction – Association Rule Mining – Metrics – Apriori Algorithm –Web Content Mining – Web Usage Mining – Web Structure Mining –Page Rank Algorithm – Precision and Recall.

MODULE V DATA QUALITY AND WAREHOUSE 9

Data quality – Types of quality analysis - Data Warehouse – Data Marts – Data Warehouse Schema –Online Analytical Processing – Knowledge of Big data and NoSQL.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Parteek Bhatia, “Data Mining and Data Warehousing Principles and Practical Techniques”, 1st Edittion, Cambridge University Press, 2019, ISBN: 9781108727747.
2. Jiawei Han &MichelineKamber, “Data Mining – Concepts and Techniques”, 3rd Edition, ISBN 978-0-12-381479- Morgan Kaufmann Publishers, Elsevier, 2012.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, ISBN: 1-892095-02-5, Pearson education,2006.

COURSE OUTCOMES:

CO1: Design appropriate data warehouse multi-dimensional model.

CO2: Perform basic data mining operations and apply standard data miningalgorithms to solve real time problems.

CO3: Correlate data mining techniques to current scenarios in various fields and inculcate the ability to apply tools for mining and analysis.

CO4: Review the various latest research activities going on in the field of Data Mining, thereby creating an interest for research

CO5: Able to mine the data and perform predictive analysis.

Board of Studies(BoS):	**Academic Council:**
20th BoS of Department of CSE held on 16.08.2022	19th Academic Council held on 29.09.2022

	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	L												L	
CO2			L										L	
CO3				L										M
CO4			M										M	
CO5		M												M

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

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

Statement: The various industrial standards data of technical drawing and the application of orthographic projections to draw simple solids helps to innovate a new design for sustainable industrialization.

CSEY 101	JAVA PROGRAMMING FOR IOT APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To gain a comprehensive understanding of Java basics.

COB2: To acquire fundamental knowledge of object-oriented programming principles in Java.

COB3: To learn advanced Java concepts including nested classes, enums, string manipulation, wrapper classes, big numbers, date/time handling, and collections.

COB4: To understand Java's concurrency model and handle exceptions effectively.

COB5: To build Java applications for solving real-world problems through practical exercises and projects.

MODULE I JAVA BASICS 9

Introduction to Java language: Brief history of Java -Java as a language - JDK, JRE and JVM - How does - JRE work - Java virtual machine; Datatypes and variables: Data types and variables - Non-primitive string - Primitive Data types - Implicit type casting or widening - Explicit type casting or narrowing; Operators: Operators - Arithmetic Operators - Unary Operators - Bitwise Logic Operators – Bitwise -Shift Operators - Comparison Operators - Logic operators - Assignment Operators - Ternary or Conditional Operator - Operator Precedence; Conditional flow control: If and Nested If statement - Switch case statement; Loops: For Loop - While Loop - Do While Loop - Infinite Loop - Break continue statements - Nested Loop - Labeled loop; Arrays: Arrays; Practice: Problem statement and solution; Methods: Creating Methods - Calling Methods - Method overloading - Recursive Methods.

MODULE II OOPS IN JAVA 9

Basics of object-oriented programming: Class, Object – Constructors - Pass by reference, Pass by value - Static fields, class variables, instance variable - static methods or class methods - Static blocks. - Inheritance - Interfaces and implementation; Java packages: Packages - creating user defined packages; Encapsulation: Encapsulation; Inheritance: Inheritance; Polymorphism: Polymorphism; Abstraction: Abstraction; Composition: Composition.

MODULE III ADVANCED CONCEPTS – I 9

Nested classes: Nested classes - Inner classes - Shadowing - Static Nested classes; Enum types: Enum types; Java string class: Java string class; Wrapper class: Wrapper class. Java Mathematics on BigInteger, Big Decimal class: Java Mathematics on BigInteger, BigDecimal class. Java Date and Time: Java Date and

Time; Formatting - Decimal, Date & Time, custom Date time formatting: Formatting - Decimal, Date & Time, custom Date time formatting; Arrays utility class: Arrays utility class; Exception handling: Exception handling; Generics: Generics; Collections: List interface – Array List – LinkedList - Vector, Stack Class - Sorting Lists - Hashset class, LinkedHashSet class – TreeSet - Queue interface - Map, HashMap, TreeMap - Immutable collections and Collection factories; Concurrency: Process and Thread Overview -Creating Threads, Pausing Thread -Thread Joins - Inter-thread communication – Deadlock – Livelock; Practice: Practice session.

MODULE IV ADVANCED CONCEPTS – II 9

Lambda expressions; Functional Interfaces: Functional Interfaces; Streams and Generating streams: Streams and Generating streams; I/O Operations and files: I/O Operations and files; Serialization: Serialization; Network programming: Network programming; Java NIO:Java NIO; JDBC Database connectivity: JDBC Database connectivity; Garbage collector and Java Runtime: Garbage collector and Java Runtime; Reflection: Reflection; Annotations: Annotations; Regular expressions: Regular expressions.

MODULE V CODE WITH US 9

Project for submission: Project

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Kathy Sierra & Bert Bates (2003), Head First Java, Shroff/O'Reilly.
2. Joshua Bloch (2017), Effective Java, Addison-Wesley Professional.
3. D. S. Guru, K. S. Manjunatha, and M. T. Somashekara (2017) Object Oriented Programming with Java, PHI Learning.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Implement Java fundamentals to solve programming problems.

CO2: Demonstrate the ability to design and implement Java applications using object-oriented principles.

CO3: Develop advanced java applications to handle complex programming scenarios.

CO4: Create multi-threaded applications, manage concurrency issues, and implement exception handling to ensure application stability and performance.

CO5: Apply Java features to develop a real world application project.

Board of Studies (BoS):
23rd BoS of CSE held on 02.09.2024

Academic Council:
22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	M	H	L				L	L	L	M	M	M
CO2	M	M	H	M	M				M	M	L	M	H	M
CO3	M	M	H	H	H				M	M	L	H	H	H
CO4	H	M	H	H	M				M	M	M	M	H	H
CO5	H	H	H	H	H				H	H	H	H	H	H

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.

Statement: The students can tackle advanced programming scenarios by being equipped with in-demand technical skills, fostering innovation, and promoting lifelong learning through a comprehensive and structured education in Java programming.

CSEY 102	.NET PROGRAMMING FOR IOT APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To gain knowledge on .NET and SQL commands.

COB2: To study the concepts of API.

COB3: To familiarize students on SOLID principles.

COB4: To provide comprehensive knowledge on .NET in Azure.

COB5: To learn to code for the given problem statement.

MODULE I INTRODUCTION TO .NET AND SQL **9**

Introduction to .NET Programming: Basics of .NET – Installation of .NET in windows/mac/Linux; Basics of C#.NET: Console app creation-Variables-Data structures- Operators and conditionals-Conditional statements- Loops, Methods, scope – Practice – problem statements and solution; Intermediate concepts in C#.NET: Models – String operations – Namespaces -Connecting with Databases and database connections -Dapper – Entity framework – Config – File operations – Read and write – JSON – Model mapping; SQL Basics & Intermediate concepts: SQL Basics – SQL Intermediate – Practice - problem statements and solution

MODULE II API BASICS AND ADVANCED CONCEPTS **9**

API Basics: Basics of API development -what is startup.cs - First custom controller - API set up. -User Models and User Controller -Put & Post -DTOs -Namespaces - EF Setup, User controller and Automapper - Assignment and solution; API Intermediate: User Repository, Auth Table- Login and Registration with details- JWT token creation and validation- Helper Classes-Posts model and controller; Stored procedures: Stored procedure creation Parameters -Nullable parameters-Temp table- User upsert and delete- Posts Get, Upsert and Delete; API Advanced: API Advanced concepts -Registration set up end to end- Controller Dynamic parameters- Advanced - assignment and solution-Reusable SQL.

MODULE III SOLID PRINCIPLES **9**

SOLID Principles for C# Developers: Single Responsibility Principle- Open/Closed Principle -Liskov substitution Principle- Interface segregation Principle- Dependency inversion Principle.

MODULE IV .NET IN AZURE 9

Azure deployment: Azure App Service -Azure SQL - Deploy .NET apps in Azure

MODULE V CODE WITH US 9

Project for submission: Assignment1 and solution -Assignment2 and solution- Project - Problem statement and solution in Azure

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Thuan L. Thai, Hoang Lam (2003), .NET Framework Essentials, 3rd Edition, O'Reilly Media, Inc.
2. Pallavi Agarwal (2021), API Fundamentals: An Easy Hands-on Workbook for Beginners, independently published.
3. AnurajParameswaran, Tamir Al Balkhi (2023), A Developer's Guide to .NET in Azure, Packt Publishing Limited.
4. https://www.udemy.com/course/net-core-with-ms-sql-beginner-to-expert/
5. https://www.pluralsight.com/courses/csharp-solid-principles

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Apply .NET programming in IoT applications.

CO2: Learn APIs and write APIs to get data from SQL using stored procedures.

CO3: Dive deep into SOLID principles

CO4: Design .NET web application and deploy in Azure

CO5: Implement real time project in .NET, SQL and deploy in Azure

Board of Studies (BoS):
23rd BoS of CSE held on 02.09.2024

Academic Council:
22nd ACM held on 04.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		M	M						L				M	H
CO2	M					M							H	M
CO3		H						M					M	
CO4			M			M								M
CO5		L	M		L				H		M			M

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The students will have productive employment by learning .NET programming and will be able to develop IoT applications for real time problems.