B.S. Abdur Rahman Crescent Institute of Science & Technology

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

Regulations 2019

Curriculum and Syllabi

(Amendments updated upto July 2021)

M.C.A.

(Master of Computer Applications)

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

REGULATIONS 2019
CURRICULUM AND SYLLABI
(Amendments updated up to July 2021)

M.C.A.
MASTER OF COMPUTER APPLICATIONS

VISION AND MISSION OF THE INSTITUTION

VISION

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

MISSION

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

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

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

MISSION

The Department of Computer Applications, endeavors

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

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

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

PROGRAMME OUTCOMES (POs)

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

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

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

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

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

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

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

PO7: Solve societal and environmentally sensitive problems in professional manner.

PO8: Demonstrate knowledge of professional and ethical responsibilities.

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

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

PO11: Adapt self-learning using their learning abilities.

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates of the department will attain the ability

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

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

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

REGULATIONS - 2019 FOR

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

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

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

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

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

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

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

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

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

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

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

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

2.2 ADMISSION REQUIREMENTS

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

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

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

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

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

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

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

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

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

		Engineering and Project Management)	Engineering) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg.)	B.E. / B. Tech. (EEE/ECE/E&I/I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Data Science)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information	B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/

		Technology)	Electronics / MCA)
9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences
		M.Tech. Food Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

14.	Commerce	M.Com	dates who have passed B.Com/BBA degree (General or any Specialization) of this Institution or authority accepted by this Institution as equivalent thereto.

3.3. STRUCTURE OF THE PROGRAMME

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

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

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

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

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

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

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

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

- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- ❖ One credit for four weeks of industrial internship or 160 hours per semester.

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

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

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

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

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

3.4. ONLINE COURSES

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

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

3.5 PROJECT WORK / DISSERTATION

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

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the

Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

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

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

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

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

4.2 FACULTY ADVISOR

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

5.0 CLASS COMMITTEE

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

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

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

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

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

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

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

6.0 COURSE COMMITTEE

6.1 Each common theory / laboratory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0 REGISTRATION AND ENROLLMENT

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

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

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

the student.

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

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

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

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / DISSERTATION

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

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18
M.Com	NA

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

10.0 ATTENDANCE

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution in approved events, etc.) to become eligible to appear for the semester end examination in that course,

failing which the student shall be awarded “I” grade in that course. The courses in which the student is awarded “I” grade, shall register and redo the course when it is offered next.

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

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

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

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule and not exceeding prescribed maximum credits.

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

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

12.0 ASSESSMENTS AND EXAMINATIONS

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

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

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

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

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

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

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

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

shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

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

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

13.0 SUBSTITUTE EXAMINATIONS

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

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

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis.

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

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

"W" denotes withdrawal from the course.

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

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

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

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

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

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

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

If C_i, is the number of credits assigned for the 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” and "W" grades are excluded for calculating GPA.

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

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

Percentage Equivalent of Marks = CGPA X 10

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

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

However, to be eligible for First Class with Distinction, a student should not have obtained ‘U’ or ‘I’ grade in any course during his/her period of study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed

the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0 DISCIPLINE

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

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

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
ii. No disciplinary action is pending against him/her.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

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

18.0 POWER TO MODIFY

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

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

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

SEMESTER I

S. No.	Course Group	Course Code	Course Title	L	T	P	C
1	MS	MAD 6188	Mathematical Foundation for Computer Applications	3	1	0	4
2	PC	CAD 6121	Computer Organization and Operating system	3	0	0	3
3	PC	CAD 6122	Database Management Systems	3	0	0	3
4	PC	CAD 6123	Computer Networks	3	0	0	3
5	PC	CAD 6124	Data structures and Algorithms using C/C++	3	0	0	3
6	ES	CAD6125	Object Oriented Software Engineering	3	0	0	3
7	PC	CAD 6126	Data structures and Algorithms Laboratory using C/C++	0	0	2	1
8	PC	CAD 6127	Programming in C and C++ Laboratory	0	0	2	1
9	PC	CAD 6128	DBMS Laboratory	0	0	2	1
							22

SEMESTER II

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

SEMESTER III

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

SEMESTER IV

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

TOTAL CREDITS : 86

Note (Mandatory Course for completion of degree):

- Students must have enrolled and completed at least one value added course.
- Also enrollment in at least one MOOC / SWAYAM course (non-credit)before the final semester.

PROGRAMME ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C
		SEMESTER II				
1	CADY 251	Digital Marketing	3	0	0	3
2	CADY 252	Management Information Systems	3	0	0	3
3	CADY 253	Multimedia Systems andComputer Graphics	3	0	0	3
4	CADY 254	Organizational Behaviour	3	0	0	3
		SEMESTER III				
MOBILE APPLICATIONS						
1	CADY 351	Mobile Commerce	3	0	0	3
2	CADY 352	Mobile Security	3	0	0	3
3	CADY 353	Mobile and Digital Forensics	3	0	0	3
CLOUD TECHNOLOGY						
4	CADY 354	Principles of Virtualization	3	0	0	3
5	CADY 355	Cloud Architectures	3	0	0	3
6	CADY 356	Cloud Storage Infrastructures	3	0	0	3
7	CADY 357	Cloud Security	3	0	0	3
8	CADY 358	Information Storage and Management	3	0	0	3
WEB APPLICATIONS AND DEVELOPMENT						
9	CADY 359	Semantic Web	3	0	0	3
10	CADY 360	Content Management System	3	0	0	3

11	CADY 361	PHP Programming	3	0	0	3
12	CADY 362	Web Mining	3	0	0	3

IOT & BIG DATA

13	CADY 363	Data Mining and Data Warehousing	3	0	0	3
14	CADY 364	Data Analytics and Visualization	3	0	0	3
15	CADY 365	Social Media analytics	3	0	0	3
16	CADY 366	Health care analytics	3	0	0	3
17	CADY 367	R Programming	3	0	0	3
18	CADY 368	Decision Support System	3	0	0	3
19	CADY 369	Predictive Analysis	3	0	0	3
20	CADY 370	Internet of Things	3	0	0	3

SEMESTER I

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

OBJECTIVES:

The objective of this course is to

- Provide mathematical background on Number System and Combinatorics
- Give Sufficient exposure to Propositions and Logical operations
- Deal and solve problems on Matrices
- Familiarize the concepts in Set Theory
- Explain the concepts in Graph Theory

MODULE I NUMBER SYSTEMS, COMBINATORICS 12

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

MODULE II PROPOSITIONS AND LOGICAL OPERATIONS 12

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

MODULE III MATRICES 12

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

MODULE IV SETS AND RELATIONS 12

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

MODULE V GRAPH THEORY 12

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

TOTAL HOURS: 60

TEXT BOOKS :

1. Judith L. Gersting, “Mathematical Structures for Computer Science”, 5th Edition, W.H. Freeman and Company, New York, 2003.
2. Grimaldi R.P. and Ramana B.V., “Discrete and Combinatorial Mathematics”, Pearson Education, 5th Edition, Harlow, 2006.
3. Veerarajan.T., “Engineering Mathematics” (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.

REFERENCE BOOKS :

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

OUTCOMES:

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

- Explain the concepts in Mathematical Induction, Set Theory, Graph theory
- Demonstrate the use of Matrices in solving linear equations
- Apply the Combinatorics, Proposition, Logical Operators involving combinatorics problems
- Solve logical proofs in Mathematical Logics derived from truth tables.
- Apply set operations and functions in solving in Set Problem.

CAD 6121	COMPUTER ORGANIZATION AND OPERATING SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Introduce the instruction sets and operations of processor.
- Explain the functions and services of Memory and I/O devices.
- Provide an understanding of the major operating system components, services and functions.
- Describe various features of processes and present both software and hardware solutions of the critical section problems.
- Explore the techniques for managing both memory and files.

MODULE I INTRODUCTION TO COMPUTER ORGANIZATION 9

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

MODULE II MEMORY AND I/O 9

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

MODULE III INTRODUCTION TO OPERATING SYSTEMS 9

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

MODULE IV PROCESS MANAGEMENT 9

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

MODULE V MEMORY AND FILE MANAGEMENT 9

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

TOTAL HOURS: 45

TEXT BOOKS :

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

REFERENCE BOOKS :

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

OUTCOMES:

On completion of this course, students will be able to

- Analyze the structure of a digital computer and demonstrate programming proficiency using the various addressing modes and the different control systems.
- Analyze the performance of processors and caches.
- Describe the functioning of memory and operations of Input-Output Organization.
- Explain the basic structure and functions of operating systems
- Identify the problems related to process management and synchronization and apply learned methods to solve basic problems.
- Discuss the features of various Memory and File management techniques.

CAD 6122 DATABASE MANAGEMENT SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

The objective of this course is to:

- Provide an introduction on database and its operations.
- Explain the fundamentals of relational systems including data models, database architectures and database manipulations.
- Train the students to construct simple and moderately advanced database queries using structured query language and apply normalization techniques.
- Educate the concept of database storage & file structure.
- Explore the concept of transaction management and origins of No SQL databases and the characteristics that distinguish them from traditional relational database management systems.

MODULE I INTRODUCTION 9

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

MODULE II RELATIONAL DATABASES 9

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

MODULE III NORMALIZATION & QUERY EVALUATION 9

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

MODULE IV DATA STORAGE AND INDEXING 9

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

tree Index Files – Static Hashing – Dynamic Hashing.

MODULE V TRANSACTION MANAGEMENT 9

Transaction Concept - Static Implementation-Concurrency Control – Protocols - Deadlock Handling-Recovery Systems-Recovery with Concurrent Transactions - Shadow Paging - Buffer Management-Case Studies-Oracle-Microsoft SQL Server- NOSQL — Characteristics - major types of NOSQL databases - NOSQL Database-as-a- Service for Web and mobile applications

TOTAL HOURS: 45

TEXT BOOKS :

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

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

REFERENCE BOOKS :

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

2 An Introduction to Database systems, C.J. Date, A. Kannan, S.

OUTCOMES:

On completion of this course, students will be able to

- List the importance of DBMS and differentiate how DBMS is better than traditional
  file processing systems.
- Illustrate the difference between a relational database and anon-relational (NOSQL) database
- Construct and normalize conceptual data models , analyze the basic structure
  of database and recognize the different views of the database.
- Describe the concepts of data storage and indexing, query evaluations and optimization techniques.
- Handle transaction management queries in SQL in real time scenario

CAD 6123	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Provide students with enough knowledge in networking, various types ofnetworks and its applications.
- Introduce the issues of data link protocols including encoding, framing,and error detection.
- Explain various switching and routing techniques
- Provide essential knowledge about Transport layer issues
- Explore the technologies of Software Defined Networking (SDN),NetworkFunctions Virtualization(NFV)

MODULE I INTRODUCTION 9

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

MODULE II NETWORK FUNDAMENTALS 9

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

MODULE III NETWORK LAYER 9

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

MODULE IV TRANSPORT LAYER 9

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

MODULE V PRESENTATION LAYER AND APPLICATIONS 9

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

TOTAL HOURS: 45

TEXT BOOKS :

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

REFERENCE BOOKS :

1. Erik Dahl man, Stefan Parkville, Johan Skold, “5G NR: The Next Generation Wireless Access Technology, Academic Press, 09-Aug-2018
2 James F. Kurose and Keith W. Ross, “Computer Networking - A Top Down Approach featuring the Internet”, 4th Edition, Addison Wesley Publishing
Company, 2007
3 William Stallings, “Data and Computer Communications”, 7th Edition, PHI, 2011
4 Andrew S. Tanenbaum, “Computer Networks”, Tata Mcgraw Hill, 5th Edition,2013.

OUTCOMES:

On completion of this course, students will be able to

- Identify and describe the layers of the OSI and TCP/IP.
- List the applications of wireless network technologies
- Make effective use of networking topologies.
- Identify the requirements for different network architecture.
- Summarize the features of an emerging paradigm software defined networking(SDN) in computer networking.

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

OBJECTIVES:

The objective of this course is to

- Study the importance of data structures in context of writing efficient programs.
- Explore the different types of searching and sorting algorithms.
- Explain basic data structures such as arrays, linked lists, stacks and queues.
- Introduce various algorithmic techniques to solve the problems
- Demonstrate the appropriate data structure and algorithm design method fora specified application.

MODULE I INTRODUCTION TO DATA STRUCTURES 9

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

MODULE II LINKED LIST AND ITS OPERATIONS 9

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

MODULE III SEARCHING AND SORTING 9

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

MODULE IV TREE AND GRAPH

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

Kruskal's Algorithms – Depth-first traversal.

MODULE V ALGORITHM ANALYSIS AND DESIGN 9

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

TOTAL HOURS : 45

TEXT BOOKS :

1. Tanenbaum A.S, Langram Y, Augestein M.J, "Data Structures using C"
   Pearson Education, 2004.
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill, 1st edition (1 July2017).

REFERENCE BOOKS :

1. Robert Kruse, Data Structures and program designing using 'C' ,3rd edition, 2007.
2. Hanumanthappa M., Practical approach to Data Structures, LaxmiPublications, Fire Wall media 2006.

OUTCOMES:

On completion of this course, students will be able to

- Describe how arrays, records, stacks, queues are represented in memory.
- Compare and contrast various sorting and searching techniques
- Evaluate algorithms and data structures in terms of time and memorycomplexity of basic operations.
- Demonstrate different methods for traversing trees
- Apply suitable shortest path algorithm in appropriate applications

CAD 6125	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Provide basic concepts of software engineering and software life cycle models.
- Explore the techniques for requirement gathering design and specification
- Give an insight into the concepts of modeling and notations of the different UML diagrams.
- Explain the strategies behind designing a project and track progress.
- Provide knowledge on software configuration management.

MODULE I INTRODUCTION TO SOFTWARE ENGINEERING 9

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

MODULE II REQUIREMENT, PLANNING & SCHEDULING 9

Introduction - Overview of requirements elicitation - Requirement elicitation concepts

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

MODULE III ANALYSIS 9

UML: Analysis Modelling - Data Modelling - Functional Modelling & Information Flow - Behavioural Modelling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process -

Object Relationship Model - Object Behaviour Model. Design modelling with UML.

MODULE IV OBJECT ORIENTED DESIGN AND INTERFACE **9**

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

MODULE V IMPLEMENTATION AND TESTING SOFTWARE CONFIGURATION MANAGEMENT **9**

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

TOTAL HOURS: 45

TEXT BOOKS :

1 Roger. S. Pressman and Bruce R. Maxim, “Software Engineering – A Practitioner’s Approach”, seventh Edition, McGraw Hill, 2015

2 Ian Sommerville, “Software Engineering”, eighth edition, Pearson Education,New Delhi, 2011.

REFERENCE BOOKS :

1 Timothy C. Lethbridge, Robert Laganiere, "Object-Oriented Software Engineering - A practical software development using UML and Java", 3rdEdition, Tata McGraw-Hill, 2006.

2 S.K.Kataria, Rajiv Chopra, "Object Oriented Software Engineering", 3rd Edition,2013.

3 Stephan R. Schach, "Object oriented and classical software engineering", 8thEdition, Tata McGraw Hill, 2010.

4 Bernd Bruegge, "Object oriented software engineering", 3rd Edition, PearsonEducation, 2009.

OUTCOMES:

On completion of this course, students will be able to

- Compare the different software life cycle models and select the appropriate model for a real time project.
- Identify the software requirement specification and formulate projectplanning in real time scenario.
- Analyze different UML concepts and illustrate the UML design for real-time project.
- Execute the object-oriented and software reusability concepts.
- Implement and test software configuration management techniques in software engineering environment.

CAD 6126	DATA STRUCTURES AND ALGORITHMS USING C/C++ LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The objective of this course is to

- Explain various sorting and searching algorithms.
- Explore linear and non linear data structures
- Design and implement algorithms for searching and sorting
- Design and implement operations on stacks, queues, and linked lists
- Introduce the Binary Search Tree implementation using.

LIST OF PROGRAMS

1. Write a C program to create a Stack and do the following operationsusing arrays and linked lists (i) Push (ii)Pop
2. Create a Queue and do the following operations using arrays and linkedlists
   i) Add (ii) Remove
3. Write a C program to implement doubly linked list
4. Write a C program to sort a list of N elements of integer type using quicksort Algorithm
5. Write a C program to sort a list of N elements using Bubble sort Technique
6. Write a C program to search for an element in an array using Binary search
7. Write a C++ program to implement insertion sort method to sort a givenlist of integers in descending order.
8. Write a C++ program to implement selection sort method to sort a givenlist of integers in descending order.
9. Write a C++ program to Create a binary search tree and do the followingtraversals
   i) In-order (ii) Pre order (iii) Post order .
10. Perform the following operations in a given graph (i)Depth first search (ii)Breadth first search
11. Find the shortest path in a given graph using Dijkstra algorithm.
12. Apply the divide and Conquer technique to arrange a set of numbers

13. Construct optimal binary search trees using dynamic programming methodof problem solving.
14. Implement knapsack problem using backtracking
15. Find the solution of traveling salesperson problem using branch and boundTechnique.

TOTAL HOURS : 30

OUTCOMES:

On completion of this course, students will be able to

- Apply various data structure such as stacks, queues, trees , linked list andgraphs to solve various computing problems .
- Choose and implement efficient data structures and apply them tosolve problems.
- Implement and analyze various searching techniques and sorting techniques
- Write programs that use arrays, records, linked structures, stacks, queues,trees, and graphs
- Develop program that implements kruskal's algorithm, prims, binary search,all types of sorting, greedy algorithm and backtracking technique.

CAD 6127	PROGRAMMING IN C and C++ LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The objective of this course is to

- Describe the basic concepts of C constructs.
- Provide knowledge on strings, pointers, functions, structures.
- Explain the necessity of Object-Oriented Programming over Traditionalprogramming.
- Illustrate concepts of Object-Oriented programming language
- Demonstrate the use of file programming.

EXPERIMENTS

C programs

- Programs using I/O statements and expressions.
  - Programs using decision-making constructs
  - Programs using looping statements (also demonstrate the use of break andcontinue statements).
  - Programs using single dimensional and multi-dimensional arrays.
  - Programs using string handling functions.
- Programs using functions and recursive functions.
  - Demonstrate the use of structure and Union
  - Demonstrate the use of Pointers.
  - Demonstrate the use of file handling.

C++ Programs

- Simple Programs using Data Types, Input/output statements and ArithmeticOperators, Conditional statements and different loops
- Programs using structures and functions
- Programs using classes, objects and scope resolution operator
- Programs using Constructors and destructors
- Demonstration of array of object.

- Demonstration using this->pointer.
- Application Programs using Simple, Multiple, Multilevel, Hierarchical and Hybrid Inheritance.
- Demonstration of Virtual function, Friend function and Static function.
- Programs to implement function overloading.
- Programs using operator overloading for Binary, Unary and relational operators.
- Demonstration of pointers to base class and derived class member functions.
- Programs using Function and Class template.
- Program to access a record using file handling.

TOTAL HOURS :30

OUTCOMES

On completion of this course, students will be able to

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

CAD 6128	DBMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

The objective of this course is to

- Learn how to create tables which are fundamental storage blocks of data.
- Learn how to place constraints on data that is entered on tables to ensure data integrity.
- Learn how to add, change and remove data from tables.
- Learn how to select a subset of the data you want to see from the collection of tables and data.
- Learn how to combine table and group multiple rows of data in table.

LIST OF PROGRAMS

1. Execute a single line and group functions for actable.
2. Execute DCL and TCL Commands.
3. Create and manipulate various DB objects for a table.
4. Create views, partitions and locks for a particular DB.
5. Write PL/SQL procedure for an application using exception handling.
6. Write PL/SQL procedure for an application using cursors.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write a PL/SQL block for transaction operations of a typical application using triggers.
9. Write a PL/SQL block for transaction operations of a typical application using package.
10. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD)

TOTAL HOURS : 60

OUTCOMES:

On completion of this course, students will be able to

- Apply iterative programming at database level.
- Write programming blocks with conditional structure, assignment structure,

loop structure, etc.

- Use exception Handling, Transaction oriented programs, Stored procedures, functions, packages, etc.
- Implement cursors which would allow row wise access of data.
- Use triggers which would allow you define pre and post actions when something change in the database tables.

SEMESTER II

CAD 6221	PROGRAMMING IN JAVA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of this course is to

- Provide basic understanding of Java fundamentals
- Explore inheritance, interfaces and packages.
- Explain Java programs to perform multi threading and exceptionHandling
- Familiarize the programming skills to use the object-oriented programming methodology to produce quality computer based solutions to real timeproblems.
- Introduce collection of AWT packages and develop programs.

MODULE I JAVA FUNDAMENTALS 9

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

MODULE II INHERITANCE AND INTERFACES 9

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

MODULE III THREADING AND EXCEPTION HANDLING 9

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

MODULE IV APPLETS AND AWT PACKAGES 9

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

MODULE V STREAM CLASSES AND I/OPACKAGES 9

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

TOTAL HOURS : 45

TEXT BOOKS :

1. Herbert Schildt, The Complete Reference – Java 2, 7th Edition, Tata McGrawHill, 2017.
2. Hortsmann & Cornell, “Core Java Advance Features VOL II”, 9th Edition, Pearson Education, 2013.

REFERENCE BOOKS :

1. Keyur shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill 2002.
2. Deitel & Deitel, Java How to Program, Prentice Hall 9th Edition 2011.

OUTCOMES:

On completion of this course, students will be able to

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

CAD 6222 RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVES:

The objective of this course is to :

- Explain mathematical model of linear programming problems
- Illustrate mathematical model of Transportation problems
- Familiarize the mathematical model of Assignment problems
- Explore network modeling for planning and scheduling the project activities
- Demonstrate Queuing Models to minimize waiting time in the queue.

MODULE I LINEAR PROGRAMMING MODELS 12

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

MODULE II TRANSPORTATION AND ASSIGNMENT MODELS 12

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

MODULE III INTEGER PROGRAMMING MODELS 12

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

MODULE IV PROJECT SCHEDULING BY PERT AND CPM 12

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

MODULE V QUEUING MODELS 12

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

TOTAL HOURS: 60

TEXT BOOKS :

1. Taha H.A., “Operations Research : An Introduction “ 8th Edition, Pearson Education, 2008

REFERENCE BOOKS :

1. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, “Operations Research”, Pearson Education, Asia, 2005
2. Gross, D. and Harris, C.M., “Fundamentals of Queueing Theory”, Wiley Student, 3rd Edition, New Jersy, 2004
3. N. D Vohra, Quantitative Techniques in Management, Tata Mcgraw Hill, 2010
4. Prem Kumar Gupta, D.S. Hira, “Operations Research”, S. Chand & Company Ltd, New Delhi, 3rd Edition , 2008

OUTCOMES:

On completion of this course, students will be able to

- Apply linear, integer programming to solve operational problem with constraints
- Solve transportation and assignment models to find optimal solution in warehousing and Travelling Problems
- Prepare project scheduling using PERT and CPM
- Identify and analyze appropriate queuing model to reduce the waiting time in queue
- Solve optimization concepts in real world problems

CAD 6223 CLOUD COMPUTING L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is to

- Explain the concept of cloud computing.
- Explore about various cloud services from different service providers.
- Illustrate the virtualization concepts in cloud environment
- Expose various ways to collaborate the cloud service online.
- Explore the different online tools available in cloud environment.

MODULE I INTRODUCTION 9

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

MODULE II CLOUD EVOLUTION AND SERVICES 9

Evolution of Cloud Computing : Hardware Evolution – Internet Software Evolution — Server Virtualization — Web Services Delivered from the Cloud : Communication as a Service (CaaS) – Infrastructure as a Service (IaaS) – Platform as a Service (PaaS) — Software as a Service (SaaS) - Cloud Deployment Models : private – public – hybrid – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM
Clouds.

MODULE III VIRTUALIZATION 9

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

MODULE IV APPLICATIONS USING CLOUD SERVICES 9

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

MODULE V COLLABORATION 9

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

TOTAL HOURS : 45

TEXT BOOKS :

1 Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles Books and Paradigms, Wiley, 2010

2 Ritting house, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.

REFERENCE BOOKS :

1 Kumar Saurabh, “Cloud Computing – Insights into New Era Infrastructure”, Wiley Indian Edition, 2011.

2 Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On- demand Computing, Applications and Data Centres in the Cloud with SLAs, Emereo Pty Limited, July 2008.

3 Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan
Kaufmann Publishers, 2012.

4 Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

OUTCOMES:

On completion of this course, students will be able to

- Apply the systems, protocols to support cloud computing.
- Identify the architecture and infrastructure of cloud computing.
- Design applications by integrating cloud services.
- Use the web based tools available in cloud.
- Collaborate using online cloud based tools.

CAD 6224 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to :

- Give an overview on different mobile development environment.
- Gain basic understanding of Android application development.
- Impart knowledge on how to build an Android application
- Understand the IOS development environment
- Provide knowledge on how to build an iOS application

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

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

MODULE II ANDROID FRAMEWORK **9**

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

MODULE III USER INTERFACE DESIGN **9**

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

MODULE IV IOS DEVELOPMENT FUNDAMENTALS **9**

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

MODULE V ADVANCED CONCEPTS IN IOS 9

Data Management - Core Data - Application Storage - External Storage - Memory Management - Leaks and Allocations - UI Design - Design Tools - Interface Builders

- Story board - View Controllers - Drawing model — Windows - Event Handling - View data Source and delegates - Multimedia and Networks - Library - Location Services - Google Maps - Apple Push and Local Notifications - Accelerometer.

TEXT BOOKS :

1 Head First Android Development –Dawn Griffiths &David Griffiehts, Second Edition,2017-O'Reilly Publication

2 IOS 13 Programming for Beginners-Fourth Edition, Ahmad Sahar, Packt Publisheing-2020

REFERENCE BOOKS :

1 Professional Android 4 Application Development-Reto Meier, Third Edition,2012- Wrox Publications

2 "Beginning iOS 6 Development: Exploring the iOS SDK", David Mark, JackNutting, Jeff La Marche and Frederic Olsson, Apress, 2013.

OUTCOMES:

On completion of this course, students will be able to

- Describe the requirements for mobile applications
- Explain the architecture and building blocks of Android
- Develop and design mobile applications using Android for specific requirements
- Explain the architecture and building blocks of iOS
- Develop and design mobile applications using iOS for specific requirements

CAD 6225 INTRODUCTION TO DATA SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to

- Explain fundamentals of data science and statistical modelling techniques.
- Describe proficiency with statistical analysis of data.
- Demonstrate on mathematical tools for data science.
- Familiarize on machine learning algorithms for predictive modelling.
- Expose to different data visualization tools and techniques.

MODULE I INTRODUCTION **9**

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

MODULE II EXPLORATORY DATA ANALYSIS **9**

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

MODULE III MATHS FOR DATA SCIENCE **9**

Mathematics for Data Science - Statistics Inferences and Probability — LinearAlgebra

MODULE IV MACHINE LEARNING **9**

Machine Learning in Data Science Supervised, unsupervised, reinforcement and deep learning, Naive Bayesian Algorithm, K means, K nearest Neighbour hood Algorithms

MODULE V DATA VISUALIZATION **9**

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

TOTAL HOURS : 45

TEXT BOOKS :

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

REFERENCE BOOKS :

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

OUTCOMES:

On completion of this course, students will be able to

- Describe the Data Science Process and how its components interact.
- Explain the significance of exploratory data analysis (EDA) in data science.
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Analyze the different basic machine learning algorithms (Linear Regression, k-Nearest Neighbours (k-NN), k-means, Naive Bayes) for predictive modelling.
- Create effective visualization of given data (to communicate or persuade).

CAD 6226	COMMUNICATION SKILLS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The objective of this course is:

- To enhance the ability of students in Learning, Speaking, Reading, Writing(LSRW) skills.
- To develop their speaking skills to interact efficiently in real life situations and in workplace
- To impart listening and reading techniques for better communication
- To improve the writing skills of students through reports, letterset.

MODULE I FUNDAMENTALS OF LANGUAGE 3

Tenses, Subject – Verb Agreement, Correction of Errors

MODULE II ORAL COMMUNICATION 15

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

MODULE III WRITTEN COMMUNICATION 6

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

MODULE IV LISTENING AND READING 6

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

TOTAL HOURS: 30

REFERENCES :

1. A.J.Thomson& A.V. Martinet, “A Practical English Grammar” Oxford University Press, 1999.

2. Andrea J. Rutherford, “Basic Communication Skills for Technology”, second edition, Pearson Education, 2007
3. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, “A Course in Communication Skills”, Cambridge University Press, India 2007
4. Krishna Mohan and Meera Banerjee, “Developing Communication Skills”, Macmillan India Ltd. (reprinted 1994-2007).
5. Riordan, Pauley, “Report Writing Today”, AIT B.S. Publisher, New Delhi (2000).
6. Gerson, Sharon, Steve m. Gerson, “Technical Writing: Process and Product”, Pearson Education, New Delhi (2004).
7. R.K. Bansal, J.P. Harrison, “Spoken English”, Orient Longman, Mumbai (1999)
8. Grant Taylor, “English Conversation Practice” Tata MC Graw Hill, New Delhi(1997).

OUTCOMES:

On completion of this course, students will be able to

- Demonstrate the efficacy of their reading and listening skills
- Speak fluently on various topics
- Participate effectively in debates and discussions
- Write professional documents like reports, letters and proposals efficiently
- Communicate clearly using appropriate vocabulary and grammatically correct expressions.

CAD 6227	ADVANCED TECHNOLOGY LABORATORY (Cloud/Mobile/Data Science)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The objective of this course is to

- Explain the fundamental concepts of cloud computing.
- Explore the services and security concepts in cloud environment.
- Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how
  and when to apply the different components to develop a working system.
- Demonstrate the basic concepts of Reprogramming
- Illustrate Data Science applications using Reprogramming

CLOUD COMPUTING

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

MOBILE APPLICATION DEVELOPMENT

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

DATA SCIENCE USING R PROGRAMMING

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

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

TOTAL HOURS: 30

OUTCOMES:

On completion of this course, students will be able to

- Implement the cloud services in real-time scenario.
- Deploy cloud computing technologies to analyze the securitymanagement in real time projects.
- Develop and deploy mobile applications for the Android operating systemusing basic and advanced phone features
- Implement basic R programming concepts.
- Analyze and plot graph for various data science applications.

CAD 6228 PROGAMMING IN JAVA LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

The objectives of this course is to

- Explain object-oriented programming techniques.
- Provide quality based software solutions to real problems.
- Familiarize the advance features of java technology.
- Demonstrate the use of application programming interface (api) and develop programs
- Illustrate multithreaded programs with exception handling mechanism.

JAVA PROGRAMMING:

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

TOTAL HOURS: 30

OUTCOMES:

On completion of this course, students will be able to

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

- Write java programs using object-oriented programming techniques inheritance, polymorphism, interface, constructors and abstract class.
- Create package for real time applications like bank transaction, employee processing etc.
- Construct multithreaded programs and handle exceptions.
- Develop programs using Applets.

SEMESTER III

CAD 7121	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES :

The objective of this course is to

- Apply various data types and control structures.
- Facilitate code reusability and explore object-oriented features.
- Learn how to use indexing and slicing to access data.
- Manipulate and preprocess the data using Pandas.
- Visualize the data in a graph, chart or other visual format.

MODULE I FUNDAMENTALS OF PYTHON 9

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

MODULE II MODULARIZATION AND OOPS CONCEPT 9

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

MODULE III INTRODUCTION TO NUMPY 9

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

MODULE IV FILE HANDLING AND DATA MANIPULATION USING PANDAS 9

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

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

MODULE V VISUALIZATION AND DATA CLEANING 9

General Matplotlib Tips – Customization of Plots – Histogram – Barcharts and Pie Charts – Scatter Plots – Data Work Flow & Importing Data – Data Cleaning: Handling of in consistent data – Detection of missing values – Removing & Replacing missing values – Duplicate Data Handling – Detection of Outliers

TOTAL HOURS : 45

TEXT BOOKS :

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning, ISBN: 978-1111822705, 2011.
2. Dusty Phillips, Python Object Oriented Programming, PACKT Press, ISBN: 9781789615852, 2018.
3. Jake VanderPlas, Python Data Science Handbook: Essential tools for working with data, O'Reilly Media, CA, 2016.

REFERENCE BOOKS :

1. Mark Lutz, Programming Python, O'Reilly Media, 5th Edition, 2013.
2. Tony Gaddis, Starting Out with Python, Pearson, 3rd Edition, ISBN-13: 978-0133862256, 2011.
3. Downey, Allen B, Think Python: How to Think Like a Computer Scientist, O'Reilly, 2nd Edition, 2016.
4. David M. Baezly, Python Cookbook, O'Reilly Media,3rd edition, 2013.

OUTCOMES :

On completion of this course, students will be able to

- Demonstrate the use of built-in data structures list, tuple and dictionary
- Implement object oriented concepts
- Process and analyze the data using Numpy
- Handle missing data and work with combining data sets using Pandas
- Understand the insight of the dataset using visualization

CAD 7122 BLOCK CHAIN TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

The objective of this course is to:

- Learn the basic concepts of Block chain Technologies.
- Impart knowledge about Block chain General Architecture.
- Learn the inventory management concepts for optimizing supply chain performance.
- Integrate block chain technologies with supply chains.
- Apply the Block chain concepts in different use cases.

MODULE I INTRODUCTION 09

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

MODULE II BLOCK CHAIN ARCHITECTURE 09

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

MODULE III MANAGING INVENTORY IN SUPPLY CHAIN 09

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

MODULE IV BLOCK CHAIN INTEGRATION WITH SUPPLY CHAINS 09

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

MODULE V CASE STUDIES 09

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

TOTAL HOURS : 45

TEXT BOOKS:

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

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

- Identify the stakeholders of the select supply chain for block chain integration.
- Design the requirement engineering metrics for the system to integrate block chain technologies.
- Select the appropriate commodity or specific product supply chain with start node and end node for the effective inventory movement.
- Write the SMART contract using Hyper Ledger.
- Evaluate and manage the supply chain with block chain integration.

CAD 7123 BIG DATA ANALYTICS L T P C
3 0 0 3

OBJECTIVES :

The objective of this course is to

- Understand the fundamental concepts of big data and analytics.
- Gain the knowledge about big data storage, processing, visualization, and application problems in real time world scenario.
- To set up single and multi-node Hadoop Clusters.
- To solve a big data problem using MapReduce technique.
- Learn how to handle the large volume of data in cloud environment.

MODULE I INTRODUCTION 9

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

MODULE II BIG DATA ARCHITECTURE 9

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

MODULE III HADOOP ECOSYSTEM 9

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

MODULE IV CLOUD SERVICES FOR BIG DATA STORAGE 9

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

MODULE V CASE STUDY 9

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

TOTAL HOURS : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

OUTCOMES:

Students who complete this course will be able to

- In-depth understanding of the concepts and intricacies of big data analytics
- Categorize and Summarize Big Data and its importance
- Learn NoSQL databases and management system
- Understand the data storage in cloud environment like Microsoft Azure & AWS
- Gain knowledge about real world applications of big data analytics.

CAD 7124 MACHINE LEARNING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

The objective of the course is to help the students to:

- Understand the basic concepts of Machine learning and explore the models.
- Apply Supervised Machine Learning Techniques for data handling.
- Understand the features of Neural network and its applications.
- Create Unsupervised Learning models for handling unknown patterns.
- Learn the concepts of Advanced and Reinforcement Learning.

MODULE I INTRODUCTION TO MACHINE LEARNING 09

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

MODULE II SUPERVISED LEARNING 09

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

MODULE III NEURAL NETWORK LEARNING 09

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

MODULE IV UNSUPERVISED LEARNING 09

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

MODULE V ADVANCED LEARNING TECHNIQUES 09

Reinforcement Learning – Representation Learning - Active Learning - Ensemble Learning - Bootstrap Aggregation - Boosting - Gradient Boosting Machines – Deep learning.

TOTAL HOURS : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

OUTCOMES:

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

- Identify and apply the appropriate techniques to process the data and solve the applications using machine learning techniques
- Gain in-depth familiarity with various supervised learning algorithms
- Implement machine learning through Neural networks.
- Understand the Unsupervised learning and dimensionality reduction

techniques.

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

CAD 7125 ADVANCED WEB DEVELOPMENT AND SERVICES

L	T	P	C
3	0	0	3

OBJECTIVES :

The objectives of this course is to

- Appraise the opportunities and challenges of Internet related Environment.
- Design Static Client website using markup languages and style sheets.
- Analyze the advantages and use of Ajax.
- Familiarize API Connection to Third party vendors.
- Apply the PHP Framework and connect with MySQL database.

MODULE I INTRODUCTION TO WWW 09

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

MODULE II BUILDING WEBSITES USING HTML5 AND CSS 09

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

MODULE III ADVANCED CLIENT SIDE SCRIPTING LANGUAGE 09

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

MODULE IV SERVER SIDE SCRIPTING LANGUAGE 09

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

party vendors.

MODULE V DATABASE AND ADVANCED PHP FRAMEWORK 09

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

TOTAL HOURS : 45

TEXT BOOKS:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.
2. Beginning PHP5, Apache, Mysql Web Development, Wrox, Elizabeth Naramore, Michael K. Glass, 2005

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

- Demonstrate the knowledge of fundamental element web and website and summarize the importance of web languages in the development of website.
- Apply Ajax, JavaScript, HTML and CSS3 effectively to create interactive and dynamic websites
- Build web applications using PHP and submit the form using GET or POST method.
- Determine numerous opportunities exist for API practitioners seeking connection with Third party vendors.
- Develop Web Application using Codeignitor and able to connect and manipulate the MySQL database.

CAD 7126	CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of this course is to

- Introduce the basic concepts of Customer Relationship Management
- Learn the different CRM Models and the art of making CRM Strategy.
- Understand the present and changing patterns of e-CRM Solutions.
- Select the appropriate CRM software tool and customize the operations.
- Apply CRM in various business verticals to provide business intelligence.

MODULE I INTRODUCTION 9

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

MODULE II CRM ROADMAP FOR BUSINESS APPLICATIONS 9

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

MODULE III e-CRM SOLUTIONS 9

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

MODULE IV SOFTWARE TOOLS FOR CRM 9

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

MODULE V CASE STUDIES 9

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

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

TOTAL HOURS : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

- Identify the right CRM frame work for the business vertical.
- Select the right CRM strategy and model for the proposed system.
- Integrate customer knowledge and interaction management.
- Select the appropriate software tool and customize its operations to implement the proposed CRM model.
- Derive business intelligence and insights from the vertical case studies

CAD 7127	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

Student will be able to

- Understand python basic operation using various functions of Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Tuple Concepts in Python.
- Acquire the skills to develop simple games in python environment.
- Explore the features of PANDAS library used in python programming

LIST OF PROGRAM TOPICS

1. Write a python program for addition, subtraction, multiplication and division of two numbers.
2. Write a python program to print Fibonacci number series.
3. Write a python program to incorporate FIZZ for any number divisible by 3 and Buzz for any number divisible for 5 and FIZZBUZZ for any number divisible by 3 and 5 as well.
4. Write a python program to collect approximate cost for a material or object and store the same in the array. Remove first and last 10 % of the listed cost from the array and compute the mean value of the array items.
5. Write a python program to create a play game called jumbled word.
6. Write a python program to random generate 50 birth dates and find how many of them have same day of the year.
7. List Programs(Python Lists & its Functionality)
    - Display of List with elements.
    - Finding the range of the Lists.
    - Indexing in the Lists (Including Negative Indexing).
    - Use of Loop in the Lists.
    - Adding, removing and Joining two Lists
8. Tuple Programs(Python Tuple & its Functionality)
    - Creation of Tuple with values.
    - Finding the range of the Tuple.
    - Indexing in the Tuple (Including Negative Indexing).

- Use of Loop in the Tuple.
- Adding, removing and Joining two Tuple

9. Dictionary Programs(Python Dictionary& its Functionality)
    - Display of unordered elements.
    - Accessing the elements in the dictionary.
    - Use of Loop in the Dictionary.
    - Adding, removing and Joining two Dictionary
10. Write a python program to convert speech to text.
11. Write a python program to create a game “MONTE HALL _ 3 - DOORS AND A TWIST”. This comprises of three doors. In which two doors contain GOAT and one door contain BMW. User has to pick his/her choice of door. If the choice of door contains BMW then user WINS otherwise LOST.
12. Write a program to plot values in chart with x-axis and y-axis.
13. Write a python program using pandas library to perform the following operation.
    - Create DataFrame
    - Manipulate the values in DataFrame
    - Barcharts
    - Pie Charts
    - Scatter Plots

TOTAL HOURS: 30

OUTCOMES :

On completion of this course, students will be able to

- Examine Python syntax and semantics using flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Numpy.
- Implement and interpret the applications to explore the data insights using visualization concept and PANDAS.

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

OBJECTIVES :

The objective of this course is to:

- Understand the software engineering process including budgeting through Mini Project.
- Plan for various activities of the project and distribute the work amongst team members.
- Cultivate hardware implementation skills using an appropriate tool.
- Practice and develop presentation skills by giving seminars on the Mini Project.
- Understand the importance of document design by compiling Technical Report on the Mini Project work carried out
- Understand the software engineering process including budgeting through Mini Project.

GUIDELINES

The students undertake individual application project based on their interest level. The projects must be approved by the project coordinators.

REPORT AND DOCUMENTATION

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

PROJECT EVALUATION CRITERIA

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

1. Internal Assessment

2. External Examination
3. Viva Voce

INTERNAL ASSESSMENT

Internal Evaluator must evaluate Internal Project work based on the following criteria:

- Project Scope, Objectives and Deliverables
- Software Requirement analysis, design, coding and testing skills
- Report writing and presentation skill

EXTERNAL EXAMINATION

The examiners make individual assessment based on the following criteria.

- Software Requirement Specifications
- Project Demonstration
- Project Report
- Viva Voce

VIVA VOCE

Confidence level, Programming knowledge, Professional approach and Communication Skill

TOTAL MARKS

1. Internal Evaluation: 75 %
2. External Evaluation: 25 %

INTERNAL EVALUATION FOR 75 MARKS

- Review1: 15 marks
- Review2: 15 marks
- Project Novelty: 5 marks
- SRS : 10 marks
- Design : 10 marks
- Coding : 10 Marks
- Testing : 5 marks

EXTERNAL EVALUATION FOR 25 MARKS

- Demonstration 5 marks
- Project Report: 10 marks
- Viva-Voce 10 marks

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

OUTCOMES :

On completion of this course, students will be able to

- Understand, plan and execute a Mini Project with team.
- Design and Model a prototype for real time system.
- Implement software/ electronic hardware by learning required testing and troubleshooting tools.
- Prepare a technical report based on the Mini project.
- Deliver technical seminar based on the Mini Project work carried out.

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

18

OBJECTIVES :

The objective of this course is to:

- Apply the knowledge and skill components in the real time / research projects.
- Understand the various software requirements and design challenges with appropriate tools.
- Apply the various skill metrics to write effective code using appropriate languages or platforms.
- Understand the practical difficulties in implementing the project with the available software and hardware resources.
- Improve the communicative efficacy by writing effective reports and providing training for the end users.

OUTCOMES :

On completion of this course, students will be able to

- Define the real time problem/ research project scopes, objectives and deliverables with project schedule.
- Design with a system modeling language tool and draw diagrams, covering all modules of the project.
- Write effective programs to develop user interface design, database design, processing logic and generate reports.
- Apply various software testing tools for the test cases and implement the project modules with a consolidated project report.
- Demonstrate the working project to the end user with system and user manual**.**

ELECTIVE I - SEMESTER II

CADY 251	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Explain a systematic approach to develop a Digital Marketing strategy
- Familiarize online marketing strategy integrated with overall marketing Objectives
- Explore email marketing as an effective marketing channel
- Expose all the essentials of mobile marketing
- Explore various strategic building process in digital marketing

MODULE I DIGITAL MARKETING BASICS 9

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

MODULE II BUILDING WEBSITE AND SEARCH ENGINEOPTIMIZATION 9

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

MODULE III ONLINE DISPLAY ADVERTISING AND ECOMMERCE MARKETING 9

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

marketing-Uploading mobile app in Android and Ios

MODULE IV CONTENT MARKETING 9

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

MODULE V ONLINE REPUTATION MANAGEMENT 9

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

TOTAL HOURS: 45

TEXT BOOKS :

1 Alan Charlesworth, ”Digital Marketing: A Practical Approach”, Routledge Publication, 2nd Edition,2014

2 “Digital Marketers Sound Off: Tips, Tactics, Tools, and Predictions”, Matt Chiera, 2018

REFERENCE BOOKS :

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

OUTCOMES:

On completion of this course, students will be able to

- List the advantages of digital marketing over traditional marketing.
- Summarize how they can use digital marketing is used to increase sales andgrow their business
- Analyze digital marketing toolkit
- Familiarize elements of the digital marketing plan
- Develop online target market and basic digital marketing objectives

CADY 252 MANAGEMENT INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to

- Explain the basic principles of Computer based Information System support the management in the various arena in the business units.
- Give an insight into the various organizational structures, culture and power.
- Provide an understanding of the Information Systems(IS) management framework of E-business. To focus on best practices, tools and models to implement an effective management system.
- Provide insights on the development and implementation of enterprise-wide IT strategies, initiatives and programs.
- Explore MIS subsystems and technologies including hardware, software and networking.

MODULE I SYSTEM CONCEPTS 9

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

MODULE II ORGANIZATIONAL STRUCTURE 9

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

MODULE III STRUCTURE OF MIS 9

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

MODULE IV SYSTEM SUPPORT 9

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

MODULE V DEVELOPMENT AND MANAGEMENT 9

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

TOTAL HOURS : 45

TEXT BOOKS :

1 James A, O'Brien, George M. Marakas , Ramesh Behl, "Management Information Systems", 10th Edition, Mcgraw Hill, 2017.

2 Harold Koontz, Heinz Weihrich, "Essentials of Management", 5th Edition, Tata McGraw Hill 1998.

REFERENCE BOOKS :

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

OUTCOMES:

On completion of this course, students will be able to

- Describe the various components of Computer based Information system suitable for the business organization.
- Compare, contrast, and choose appropriate hardware, software, database and networking suitable for the organizational Information system.
- Distinguish and analyze ethical problems that occur in business and society
- Apply leadership skills and competencies in business situations
- Illustrate how current technologies and decision-support tools can be utilized to the advantage of business operations.

CADY 253	MULTIMEDIA SYSTEMS AND COMPUTER GRAPHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Explain the basic concept of multimedia and its hardware /Software
- Explore the various multimedia tools and its usage
- Familiarize the importance of internet in multimedia applications
- Introduce basic graphics and design algorithms
- Illustrate the concept of 2D and 3Dtransformation

MODULE I INTRODUCTION 9

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

MODULE II MULTIMEDIA TOOLS 9

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

MODULE III MULTIMEDIA AND THE INTERNET 9

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

MODULE IV GRAPHICS PRIMITIVES 9

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

MODULE V 2D AND 3D TRANSFORMATIONS 9

Two dimensional transformations – Scaling and Rotations – Interactive Input methods — Polygons — Splines — Bezier Curves Window view port mapping transformation — 3D Concepts — Projections.

TOTAL HOURS: 45

TEXT BOOKS :

1 Tay Vaughan," Multimedia: Making It Work", 8th Edition , 2011, McGraw-Hill (Unit 1, Unit 2 and Unit 3)

2 Hearn D and Baker M.P, "Computer graphics — C Version", 2nd Edition, Pearson Education, 2004 (Unit 4 and 5)

REFERENCE BOOKS :

1 K. Andleigh and K. Thakkrar , "Multimedia System Design", 1996, Prentice Hall PTR

2 Steve Rimmer, "Advanced multimedia programming", Windcrest /McGraw-Hill, 1995

OUTCOMES:

On completion of this course, students will be able to

- Analyze the technical aspect of Multimedia Systems.
- Develop various Multimedia Systems application for real time scenario.
- Apply various networking protocols for multimedia applications.
- Evaluate multimedia application for its optimum performance.
- Create a multimedia component using various tools and techniques.

CADY 254 ORGANIZATIONAL BEHAVIOUR

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of this course is to:

- Introduce the basic concepts of technical leadership.
- Learn the different talent management process.
- Understand the work behavior and organizational components.
- Comprehend and apply work ethics.
- Apply human resources guidelines for talent recognition.

MODULE I LEADERSHIP **9**

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

MODULE II TALENT MANAGEMENT **9**

Talented Professionals – Importance - Characterization - Identification – Assessment and Recognizing Talent - Purpose of Talent Management - Talent management process - Development - Development Needs – Counseling and Mentoring

MODULE III CONFLICT MANAGEMENT **9**

Reasons for conflict - Conflict frames of reference - Conflict levels and cause - Conflict management: resolution approaches, stimulation approaches - Organizational justice: Components, Consequences - work behaviors: citizenship behavior, Counter-productive behavior

MODULE IV ETHICS IN ORGANIZATION **9**

Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg‘s theory – Gilligan‘s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

MODULE V INNOVATION AND RECOGNITION 9

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

TOTAL HOURS : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

OUTCOMES :

Students would be encouraged to:

- Lead a team for successful project performance.
- Counsel the peer group.
- Identify human values, moral, social values and loyalty in an organization.
- Create and manage innovative teams.
- Recognize the performer for awards and rewards.

ELECTIVE II - SEMESTER III

CADY 351	MOBILE COMMERCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to

- Introduce electronic commerce strategies and value chains.
- Learn the mobile commerce services.
- Understand mobile-commerce infrastructure and applications.
- Facilitate the learner about the deployment of payment gateway services.
- Analyze the case studies.

MODULE I ELECTRONIC COMMERCE 9

Introduction -The e-commerce environment - The e-commerce marketplace -Focus on portals, Location of trading in the marketplace - Commercial arrangement for transactions - Focus on auctions - Business models for e-commerce – e-CRM – e-SCM - Revenue models - Focus on internet start-up companies - the dot-com - E-commerce versus E-business.

MODULE II MOBILE COMMERCE 9

Introduction – Infrastructure Of M–Commerce – Types of Mobile Commerce Services – Technologies of Wireless Business – Benefits and Limitations, Support, Mobile Marketing & Advertisement, non–Internet Applications In M–Commerce – Wireless/Wired Commerce Comparisons.

MODULE III FRAMEWORK AND ARCHITECTURE 9

A Framework for The Study of Mobile Commerce – NTT Docomo's I– Mode – Wireless Devices for Mobile Commerce – Towards A Classification Framework for Mobile Location Based Services – Wireless Personal and Local Area Networks – The Impact of Technology Advances on Strategy Formulation in Mobile Communications Networks.

MODULE IV PAYMENT GATEWAYS 9

Payment Gateway Architecture – Software Components of Payment Gateway – Requirements of Payment Gateway – Types of Payment Gateway – Steps in Building a Payment Gateway – Security in Payment Gateways.

MODULE V MOBILE COMMERCE: CASE STUDIES 9

Mobile Data Technologies and Small Business Adoption and Diffusion – M–Commerce in The Automotive Industry – Location– Based Services: Criteria for Adoption and Solution Deployment – The Role of Mobile Advertising in Building a Brand – M–Commerce Business.

TOTAL HOURS : 45

TEXT BOOKS:

1. E-Commerce and Mobile Commerce Technologies, by Pandey U.S. & Shukla Saurabh | 9 July 2018.
2. Mobile Commerce, by Karabi Bandyopadhyay | 1 December 2013.
3. E-Payment Gateway A Complete Guide - 2019 Edition, by Gerardus Blokdyk.

REFERENCES:

1 Michael P. Papazoglou, Peter M.A. Ribbers, ‘e-business organizational and Technical foundation ‘, Wiley India 2009.
2 Dr. Pandey, Saurabh Shukla E-commerce and Mobile commerce Technologies , Sultan chand ,2011.
3 Dave Chaffey, “E-Business and E-Commerce Management”, Third Edition, 2009, Pearson Education.
4. Brian E. Mennecke, Troy J. Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.

OUTCOMES:

Students who complete this course will be able to

- Apply E – commerce principles in market place.
- Implement M – commerce principles to various business domains.
- Design the applications of M-commerce in business domain.
- Deploy security measures in mobile commerce application.
- Implement the case studies.

CADY 352 MOBILE SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to

- Introduce the threats and awareness of mobile security.
- Understand the encryption and decryption techniques.
- Learn security issues in mobile networks.
- Explore emerging trends in mobile security.
- Study about different types of security threats and vulnerabilites.

MODULE I INTRODUCTION 9

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

MODULE II NETWORK AUTHENTICATION 9

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

MODULE III SECURITY ISSUES 9

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

MODULE IV SECURITY TYPES 9

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

MODULE V SECURITY THREATS 9

Security Threats and Vulnerabilities - Virus - Trojan - Rootkits - Backdoors - Botnets - Man in the middle attack - Dos and DDos - Replay attack - Spoofing -

Spam - Phishing - privilege escalation - DNS poisoning - Brute force - Dictionary attack - Cross-site scripting - SQL injection - Zero-day attack - Session hijacking - Vulnerability scanning vs Port Scanning - Honeypots - Banner grabbing - Social Engineering.

TOTAL HOURS : 45

TEXT BOOKS:

1. Mobile Phone Security and Forensics, A Practical Approach, Andreoulakis, Iosif I.,2012.
2. Mobile Application Security, Himanshu Dviwedi, Chris Clark and David Thiel, 1st Edition
3. Hideki Imai, Mohammad Ghulam Rahman and KazukuniKobari "Wireless Communications Security", Universal Personal Communications of Artech House, 2006
4. Stallings William, "Wireless Communications and Networks" Second Edition, Pearson Education Ltd, 2009.
5 Security of Mobile Communications, Noureddine Boudriga, 2009

OUTCOMES:

Students who complete this course will be able to

- Identify various threats in mobile communication.
- Analyze encryption techniques.
- Implement various security and cryptographic techniques.
- Develop a clear view of integrated security environments consisting of both similar and diverse wireless access technologies and security architectures.
- Understand common threats and vulnerabilities related to mobile computing networks, and explain the concepts of defending against and managing network attacks

CADY 353 MOBILE AND DIGITAL FORENSICS

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of this course is to

- Incorporate the foundational understanding of Digital mobile forensics.
- Understand the fundamentals and advanced issues of various threats faced by today's Mobile cyber operation infrastructure.
- Know the functionality of mobile network operating systems from a point of forensic view.
- Explain the different forensics tools and their operations.
- Illustrate the importance of report generations with real-time case studies.

MODULE I INTRODUCTION TO DIGITAL MOBILE FORENSICS 9

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

MODULE II MOBILE DEVICE FORENSICS I 9

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

MODULE III MOBILE DEVICE FORENSICS II 9

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

MODULE IV OPERATING SYSTEMS IN MOBILE FORENSICS 9

Mobile operating systems overview: Procedures for handling an Android device - How to Circumvent the Pass Code-Recovery mode. Data Acquisition from iOS Devices- Operating modes of iOS devices- Recovery mode. Windows Phone Forensics- Windows Phone OS- Security model- Windows Phone file system- Extracting SMS and application data.

MODULE V REPORT WRITING FOR HIGH-TECH INVESTIGATIONS 9

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

TOTAL HOURS : 45

TEXT BOOKS :

1. Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices, 4th Edition Paperback – Import, 9 April 2020.
2. Mobile forensics: Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices, 4th Edition by Satish Bommisetty ,Rohit Tamma ,Heather Mahalik, 21 July 2014.
3. Nelson B, Phillips, Enfinger F, Stuart C., “Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, ISBN: 0-619-21706-5, 2006.
4. The Basics of Digital Forensics the Primer for Getting Started in Digital Forensics, John Sammons Technical Editor Jonathan Rajewski. SYNGRESS,Elsevier, ISBN 978-1-59749-661-2, 2012.
5. Android Forensics Investigation, Analysis, and Mobile Security for Google Android, Andrew Hoog John McCash, SYNGRESS ,Elsevier , 2011 .
6. Mobile Phone Security and Forensics A Practical Approach Authors: Androulidakis, Iosif I. ISBN 978-3-319-29742-2,Springer ,2016.

OUTCOMES :

Students who complete this course will be able to

- Understand the fundamentals of forensics standards and they have to follow in order to collect evidences from the mobile devices.
- Learn the issues of data recovery and analyze and validate forensics data.
- Examine malicious files, logs of different operating system in a forensically sound manner.
- Learn to report writing for forensic cases.

CADY 354 PRINCIPLES OF VIRTUALIZATION

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to help the students to:

- Understand Virtualization Concepts, Technologies, Architecture and Applications
- Understand the Principle of Virtualization, Storage, Data Management and Data Visualization
- Understand and Apply Various Types of Virtualization
- Understand Different Cloud Programming Platforms and Deploy Applications on Cloud

MODULE I INTRODUCTION 9

Virtualization definition – Virtual machine basics – Need and Applications of Virtualization –Virtualization Technologies – Benefits and Limitations − Traditional vs. Contemporary Virtualization process – Simulations and Emulations – Pitfalls of virtualization– Taxonomy – Challenges.

MODULE II TYPES OF VIRTUALIZATION 9

Types of hardware virtualization: Full virtualization - Para virtualization – Desktop virtualization- Server virtualization – Data virtualization – OS level virtualization - Application level virtualization – Memory and I/O virtualization – Comparing Virtualization approaches – Managing storage for virtual machines

MODULE III VIRTUAL MACHINE 9

Understanding virtual machines − Taxonomy of virtual machines – Life cycle − Process and system level virtual machines – Emulation – Binary translation techniques –Virtualising storage – Managing storage for virtual machines– Backup and recovery virtual machine – Applications of virtual machines.

MODULE IV HYPERVISORS 9

Introduction to Hypervisors – Types of Hypervisors – Hypervisor architecture – Comparing hypervisors – Virtualization considerations for cloud providers – Building and managing Virtual machines − Algorithms for implementation of Virtualization − Virtualization performance and Security Performance issues − VMWare VSphere − Virtual Box − VM attacks, VM migration attacks, Security solutions

MODULE V AUTOMATION & CLOUD 9

Automating the Data Center–Benefits of data center automation – Software defined data center - Backup - Disaster recovery – Virtualization and Cloud, Anatomy of Cloud, Benefits of Cloud, Cloud Delivery and Deployment models.

TOTAL HOURS : 45

TEXT BOOKS:

1. Matthew Portney, “Virtualization Essentials”, John Wiley & Sons, 2012.
2. Nadeau,Tim Cerng, Je Buller, Chuck Enstall, Richard Ruiz, “ Mastering Microsoft Virtualization” , Wiley Publication, 2010.
3. Nelson Ruest, Danielle Ruest, “Virtualization, A beginners guide” , 2009, MGH.
4. Venkata Josyula, Malcolm Orr, Greg Page, “Cloud Computing: Automating the Virtualized Data Center”, Cisco Press/Pearson, 2012

REFERENCE BOOKS:

1. Venkata Josyula, Malcolm Orr, Greg Page, “Cloud Computing: Automating the Virtualized Data Center”, Cisco Press/Pearson, 2012
2 Matthew Portney, Virtualization Essentials, John Wiley & Sons, 2012.
3. Dave Shackleford, Virtualization security, protecting virtualized environment, John Wiley, 2012.
4 Edward Haletky, “VMware ESX and ESXi in the Enterprise – Planning Deployment of Virtualization Servers” [ISBN: 978-0137058976]., Prentice Hall; 2 edition February 18, 2011
5 Chris Wolf and Erick M. Halter, “Virtualization” A press; 1 edition 2005.

OUTCOMES:

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

- Understanding and Implementation of virtual machines.
- Create and Configure the Hypervisors in Cloud.
- Apply the Virtualization Concepts in Server and Manage the Storage Capacity.
- Analyze, Identify and Select Suitable Type of Virtualization.
- Use the Management Tools for Managing the Virtualized Cloud Infrastructure.
- Apply Suitable Automation and Security Methods on Data Centre

CADY 355 CLOUD ARCHITECTURES

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of the course is to

- Understand the broad perceptive of cloud architecture and model
- Provide the core concepts used in cloud computing.
- Explore the lead players in cloud and design of cloud Services.
- Gain the knowledge of Virtualization techniques.
- Learn the security and trusted cloud Computing system.

MODULE I CLOUD PLATFORM ARCHITECTURE OVER VIRTUALIZED DATA CENTERS **9**

Cloud Computing and Service Models: Public, Private, and Hybrid Clouds, Cloud Eco system and Enabling Technologies, Infrastructure-as- a- Service (IaaS), Platform- and Software-as-a-Service (Paas, SaaS). Architectural Design of Compute and Storage Clouds: A Generic Cloud architecture Design, Layered Cloud Architectural development, Virtualization Support and Disaster Recovery, Architectural Design Challenges.

MODULE II CLOUD COMPUTING STANDARDS **9**

Best Practices and Standards, Practical Issues- Interoperability- Portability- Integration- Security, Standards Organizations and Groups- Cloud Security Alliance- Distributed Management Task Force (DMTF)- National Institute of Standards and Technology (NIST)- Open Cloud Consortium (OCC)- Open Grid Forum (OGF)- Object Management Group (OMG)- Storage Networking Industry Association (SNIA)- Cloud Computing Interoperability Forum (CCIF)- Vertical Groups.

MODULE III CLOUD VENDORS AND SERVICE MANAGEMENT **9**

Amazon cloud, AWS Overview, Installation of AWS, Google app engine, azure cloud, sales force. Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously , Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud , Large Scale Data Processing

MODULE IV VIRTUALIZATION 9

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation. Introduction to Map Reduce, GFS, HDFS, Hadoop Framework.

MODULE V SECURITY CONCEPTS 9

Cloud security challenges, Cloud security approaches: encryption, tokenization/obfuscation, cloud security alliance standards, cloud security models and related patterns, Cloud security in mainstream vendor solutions, Mainstream Cloud security offerings: security assessment, secure Cloud architecture design, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Case Study on Open Source & Commercial Clouds: Eucalyptus, Microsoft Azure, Amazon EC2.

TOTAL HOURS : 45

TEXT BOOKS :

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, The McGraw-Hill.
2. Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more. by Dr. Kris Jamsa.
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India.
6. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
7. Gautam Shroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
8. Dimitris N. Chorafas, “Cloud Computing Strategies” CRC Press; 1 edition [ISBN: 1439834539], 2010.

OUTCOMES :

Students who complete this course will be able to

- Understand common reasons why SaaS solutions are selected over traditional software purchases.
- Learn how global infrastructure facilitates cloud computing.
- Design Cloud Services and Set a private cloud
- Apply suitable virtualization concept.
- Address the core issues of cloud computing such as security, privacy and interoperability.

CADY 356 CLOUD STORAGE INFRASTRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES :

The objectives of this course is to

- Appraise the opportunities and challenges of information management in business environment.
- Compare the modern security concepts and assess the security of virtual systems.
- Evaluate Information storage management in a cloud environment and how it relates to the business objectives of an organization.
- Familiarize in types of storage system and solutions.
- Implementation of storage in Google cloud.

MODULE I INFORMATION STORAGE AND DATA CENTER ENVIRONMENT 9

Information Storage : Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Database Management System, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct Attached Storage, Storage Design based on Application.

MODULE II SECURING STORAGE INFORMATION 9

Information security framework, Risk Triad, Storage Security Domains – Security Implementation in Storage Networking, Securing Implementation in Storage Networking – Securing Storage Infrastructure in Virtualized and Cloud Environments – Concepts in Practice RSA and VMware Security Products.

MODULE III MANAGING STORAGE INFORMATION 9

Monitoring the Storage Infrastructure – Storage Infrastructure Management Activities – Storage Infrastructure Management Challenges – Developing an Ideal Solution -Information Lifecycle Management – Storage Tiering – Concepts in Practice: EMC Infrastructure Management Tools.

MODULE IV STORAGE SYSTEM AND SOLUTION 9

Types of Storage System – Storage System in Characteristics – Storage Solution Packaging Approaches – Converged Infrastructures and Services – Gateways,

Appliances, Adapters and Accessories – Storage Management Software - Resiliency Inside and Outside Storage Solutions.

MODULE V GOOGLE CLOUD STORAGE 9

Object Storage: Concepts, Storing data in Cloud Storage, Access Control, Object Version, Change notifications, Common use Cases, Understanding Pricing, Cloud Storage usage.

TOTAL HOURS : 45

TEXT BOOKS:

1. EMC, “Information Storage and Management” Wiley; II Edition [ISBN : 978-0470294215], 2012
2. Greg Scholz, “Software –defined Data Infrastructures Essentials”, CRC Press, [ISBN : 978-14987-3815-6] ; 2017
3. JJ Geewax, “Google Cloud Platform in action” , [ISBN : 978-161-7293528], 2018.

REFERENCES :

1. Volker Heminghaus Albert Scriba, “Storage Management in Data Centers” Springer; [ISBN :978-3540850229] 2009.
2. Marty Ponaiatowski, “Foundations of Green IT Prentice Hall; [ISBN:978-0137043750], 2012.
3. Klaus Schmidt, “High Availability and Disaster Recovery” Springer; [ISBN : 978-3540244608], 2006.

OUTCOMES :

Students who complete this course will be able to

- Understand the key dimensions of the challenges about Data center in business environment.
- Design Information Secure framework and implement various core security controls for Cloud Computing.
- Develop an ideal solution in information management relates to the business environment.
- Analyze the types of storage system and its strategies to implement in Cloud Storage.
- Deployment of data in Google cloud storage.
- Determine numerous opportunities exist for practitioners seeking to create solutions for cloud storage.

CADY 357 CLOUD SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES :

The objectives of this course is to

- Assess the key security and compliance challenges.
- Analyze the Security Architecture and Evaluate Risk issues.
- Depicts Security Management framework and the standards.
- Appraise the management of a business physical cloud Environment.
- Review the usability and Integrity of a network and its data.
- Compare the difference from Traditional IT in all varieties of Management.

MODULE I SECURITY FUNDAMENTALS AND CHALLENGES 9

Cloud Computing Software Security Fundamentals : Cloud Information Security Objectives – Cloud Security Services – Relevant Cloud Security Design Principles – Secure Cloud Software Requirements –Approaches to Cloud Software Requirement Engineering – Cloud Security Policy Implementation – Secure Cloud Software Testing – Cloud Penetration Testing – Regression. Cloud Computing Security Challenges: Security Policy Implementation – Policy Types –Computer Security Incident Response Team (CSIRT) – Virtualization Security Management.

MODULE II SECURITY ARCHITECTURE AND RISK ISSUES 9

Cloud Computing Security Architecture: Architectural Considerations – Identity Management and Access Control – Autonomic Control. Cloud Computing Risk Issues: The CIA Triad – Privacy and Compliance Risks – Threat to Infrastructure, Data and Access Control – Cloud Service Provider Risks.

MODULE III SECURITY MANAGEMENT 9

Security Management in the Cloud: Security Management Standards- Availability Management – SaaS Availability Management – PaaS Availability Management – IaaS Availability Management – Access Control – Security Vulnerability, patch, and Configuration Management.

MODULE IV DATA AND CLOUD ASSET MANAGEMENT 9

Data Asset Management and Protection: Data Identification and Classification- Data Asset Management in the Cloud - Protecting Data in the Cloud. Cloud Asset Management and Protection: Differences from Traditional IT – Types of Cloud

Assets – Asset Management Pipeline – Tagging Cloud Assets.

MODULE V NETWORK SECURITY 9

Network Security: Differences from Traditional IT – Concepts and Definitions – Sample Application. Detecting ,Responding to, and Recovering from Security Incidents: Differences from Traditional IT – What to Watch – How to Watch – Preparing for an Incident – Recovery – Example Metrics – Example Tools for Detection , Response, and Recovery.

TOTAL HOURS : 45

TEXT BOOKS :

1. Chris Dotson, “Practical Cloud Security” O’Reiliy Media; [ISBN: 978-1-492-03751], 2019.
2. Ronald L. Krutz and Rusell Dean Vines “Cloud Security – A Comprehensive Guide to Secure Cloud Computing” Wiley Publication; [ISBN : 978-0-470-58987-8], II Edition 2021.
3. Tim Mather, Subra Kumarasway, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risk and Compliance “ O’Reiliy Media; [ISBN :0596802765], 2009

REFERENCES :

1. John R.Vacca “ Cloud Computing Security :Foundation and Challenges” CRC Press; ISBN [918-0-429-05512-6] , 2016
2. Timothy Grance, Wayne Jansen; NIST “Guidelines on security and Privacy in public Cloud Computing” ,'2011
3. J.R.(“Vic”)Winkler, “Securing the cloud” Syngress [ISBN : 1597495921], 2011.

OUTCOMES :

Students who complete this course will be able to

- Understand the key dimensions of the challenges and benefits of Cloud Computing.
- Design Secure cloud Architectures and implement various core security controls for Cloud Computing.
- Create a secure – minded workforce and protect the Organization Reputation.

- To track of every aspects of cloud estate, Managing the maintenance, Compliance and disposal of Cloud.
- Develop applications for cloud computing by understanding the System, Protocols and Mechanisms to support cloud computing.
- Determine numerous opportunities exist for practitioners seeking to create solutions for cloud computing.

CADY 358 INFORMATION STORAGE AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

The objective of the course is

- To introduce the concepts of the Storage architecture and Information Lifecycle.
- To understand the basic components of Data Center Environment and apply Database management system.
- To distinguish between different types of Intelligent Storage Systems.
- To learn to deploy the proposed system in the cloud
- To provide security for Storage Infrastructure and Cloud Environments.

MODULE I STORAGE SYSTEMS 9

Overview of information storage, Evolution of storage Architecture, Information Lifecycle Management concept, Data Center Infrastructure, Virtualization and Cloud Computing.

MODULE II DATA CENTER ENVIRONMENT 9

Application, Database Management System, Host (Computer), Connectivity, Storage, Disk Drive Components, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing.

MODULE III INTELLIGENT STORAGE SYSTEMS 9

Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems, Intelligent Storage Array.

MODULE IV CLOUD COMPUTING 9

Cloud Enabling Technologies, Characteristics and Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges.

MODULE V SECURING THE STORAGE INFRASTRUCTURE 9

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments.

TOTAL HOURS : 45

TEXT BOOKS :

1. G. Somasundaram, Alok Shrivastava, EMC Education Services, Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments 2nd Edition, 2012, 2nd Edition, Wiley publications.
2. Robert Spalding, Storage Networks: The Complete Reference, 2017, McGraw Hill Education.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002

OUTCOMES :

Students who complete this course will be able to

- Design the storage architecture for the information.
- Retrieve data from the storage and analyze it with the database management system.
- Apply the concepts of intelligent storage techniques.
- Store and manage data in a cloud.
- Provide storage security to the Information Storage System

CADY 359 **SEMANTIC WEB** **L T P C**
3 0 0 3

OBJECTIVES:

The objective of this course is :

- To learn the importance of semantic web.
- To appreciate the merits of semantic web over traditional web.
- To know the methods to discover, classify and build ontology for more reasonable results in searching.
- To learn and appreciate RDF and its taxonomy.
- To describe OWL and its usage in semantic web.
- Implement applications that can access, use and manipulate the ontology

MODULE I INTRODUCTION 9

Introduction to the Syntactic web and Semantic Web – Evolution of the Web – The visual and syntactic web – Levels of Semantics – Metadata for web information - The semantic web architecture and technologies –Contrasting Semantic with Conventional Technologies – Semantic Modeling -Potential of semantic web solutions and challenges of adoption.

MODULE II ONTOLOGICAL ENGINEERING 9

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies – Terminological aspects: concepts,terms, relations between them – Complex Objects –Subclasses and Sub-properties definitions–Upper Ontologies – Quality – Uses - Types of terminological resources for ontology building –Methods and methodologies for building ontologies – Multilingual Ontologies -Ontology Developmentprocess and Life cycle – Methods for Ontology Learning – Ontology Evolution – Versioning.

MODULE III DESCRIBING WEB RESOURCES 9

RDF Overview-The basic elements of RDF-RDF triples-Fundamental rules of RDFAggregation and distributed information-RDF tools-RDFS, Taxonomy, and Ontology-Need for RDFS-Core elements of RDFS .

MODULE IV WEB ONTOLOGY LANGUAGE 9

Requirements for Ontology Languages-OWLSublanguages-Description of the OWL Language-Layering of OWL-Examples for OWL-OWL in OWL-Namespaces, Classes of Classes, Class Equivalence, Building Classes from Other Classes, Restricting Properties of Classes.

MODULE V REAL-WORLD EXAMPLES AND APPLICATIONS 9

Swoogle- architecture, usage and examples-FOAF: Friend of a Friend-Basic FOAF vocabulary and examples-Applications-Information publishing, data integration, knowledge management, e-learning, web-services.

TOTAL HOURS : 45

TEXT BOOKS :

1. Grigoris Antoniou, Frank Van, “Semantic Web Primer”, MIT Press 5. Robert M. Colomb, “Ontology and the Semantic Web”, Volume 156 ,Frontier in Artificial Intelligence and Applications, IOS Press, 2007
2. Karin K. Breitman, Marco Antonio Casanova and Walter Truszowski, “Semantic Web Concepts: Technologies and Applications”, Springer, 2007

REFERENCES :

1. LiyangYu, “Introduction to the Semantic Web and Semantic web services” Chapman & Hall/CRC, Taylor & Francis group, 2007
2. Peter Mika, “Social networks and the SemanticWeb”, Springer, 1st edition
3. Robert M. Colomb, “Ontology and the Semantic Web”, Volume 156 ,Frontier in Artificial Intelligence and Applications, IOS Press, 2007

OUTCOMES :

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

- Understand semantic web basics, architecture and technologies.
- Compare conventional web with semantic web.
- Understand the semantic relationships among the data elements using Resource Description Framework (RDF)
- Know the methods to discover, classify and build ontology.
- Design and implement real-world applications that “discovers” the data and/or other web services via the semantic web

CADY 360 CONTENT MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of this course is to:

- To impart knowledge in installing CMS and how CMS differ from website builder
- To introduce the design layout and create the functionality with correct permissions
- To train the student on the e-commerce workshop and trouble shooting
- Provide knowledge on the core modules, using Smarty to build templates with own functionality
- To train the students in using an open source content management (CMS) tool – Joomla, A powerful and robust tool

MODULE I INTRODUCTION 9

Content Management System (CMS) – Introduction - Getting Started - CMS versus website builder – Creating Pages and Navigation.

MODULE II DESIGN AND FUNCTION 9

Design and Layout - Using Core modules – Users and Permissions – Using Third-party Modules – Creating Own Functionality.

MODULE III WORKSHOP AND TROUBLESHOOTING 9

E-commerce workshop - Advanced Use of CMS - Administration and Trouble Shooting.

MODULE IV WEB PAGE ADMINISTRATION 9

Introduction to dynamic web pages and development tools for dynamic content– Downloading tools for dynamic content – Downloading and installing a content Management System (Joomla!) – Administration elements of a Content ManagementSystem – Organizing Content.

MODULE V CASE STUDY 9

Basic elements: pages, menus and navigation – incorporate components, modules, plug-ins and languages – Case Studies: Marketing strategies and planning for websites – Design and create a school website, restaurant website, blog site,

Securing Content Management System.

TOTAL HOURS : 45

TEXT BOOKS :

1. CMS Made simple 1.5, Sofia Hauschildt, 2010.
2. Joomla! 1.5: A User's Guide – Barrie M. North Second Edition, Prentice Hall.

OUTCOMES :

On completion of this course, students will be able to

- install CMS made simple (CMSMS), Converting other website templates to work with CMSMS
- add a e-commerce functionality and a discussion of users and permissions
- develop a successful website powered by Joomla
- list the advanced use of CMS
- incorporate components, modules, plug-ins and languages

CADY 361 PHP PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

The objectives of the course is to:

- Understand how server-side programming works on the web.
- PHP Basic syntax for variable types and calculations.
- Creating conditional structures and using arrays
- Using PHP built-in functions and creating custom functions
- Understanding POST and GET in form submission.
- Reading and writing cookies.

MODULE I INTRODUCTION 9

Introduction to PHP Evaluation of PHP, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html. Array Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(),Some useful Library function.

MODULE II HANDLING HTML FORMS 9

Form Handling –PHP Interactive Forms-PHP GET & POST-Form Validation-PHP Form sanitization-PHP Form URL/E-mail – Basics of Computer Graphics-Creating Image-Manipulating Image-Using Text in Image-Watermarks to Image

MODULE III JAVA SCRIPT WITH PHP 9

JavaScript - Variables, data types, expressions, operators; Conditional, iteration, statements; Functions; Arrays; DOM, Events, Events Handling; Client-side Persistence; Object-Oriented JS; Ajax. Overview of JavaScript Libraries / Frameworks.

MODULE IV DATABASE CONNECTIVITY 9

Session and Cookies - Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session. Database Management –Introduction to MySQL –MySQL Commands –MySQL Database Creation –Connecting MySQL and PHP –Querying MySQL Database with

PHP.

MODULE V APPLICATION FRAMEWORKS 9

Web Development Frameworks –Introduction – Model View Controller – PHP framework–PHP XML Parsers-PHP XML Expat-PHP XML DOM-PHP Mail – Pilot project.

TOTAL HOURS : 45

TEXTBOOKS:

1. PHP and MySQL Web Development (Developer's Library) 5th Edition by Luke Welling, Laura Thomson
2. The Joy of PHP Programming: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL by Alan Forbes, Fifth Edition, Plum Island publishers
3. PHP & MySQL Novice to Ninja**,** by Tom Butler & Kevin Yank, Sixth Edition, SitePoint publisher.
4. PHP: A Beginner's Guide, by Vikram Vaswani, First Edition, McGraw-Hill Education Publication.

REFERENCES:

1 PHP In Action: Objects, Design, Agility, by Daginn Reiersol, Chris Shiflett, and Marcus Baker, 1st Edition, Manning Publications

2 Learning PHP, MySQL, JavaScript, & CSS: A Step-by-Step Guide to Creating Dynamic Websites, by Robin Nixon, Second Edition, O'Reilly publications

OUTCOMES:

Students who complete this course will be able to

- Write PHP scripts to handle HTML forms.
- Write regular expressions including modifiers, operators, and metacharacters.
- Create PHP programs that use various PHP library functions, and that manipulate files and directories.
- Analyze and solve common Web application tasks by writing PHP programs.
- Establishing database connection.

CADY 362 WEB MINING L T P C
3 0 0 3

OBJECTIVES:

The objective of this Course is to

- Focus on the basics of Information retrieval and Web search.
- Explore social media data using appropriate web mining techniques and main design principles of Web crawlers.
- Familiarize the fundamentals for structure data extraction and techniques for processing Web documents.
- Learn to extract and process opinions and sentiments in text contents.
- Illustrate the various aspects of web usage mining.

MODULE I INTRODUCTION 9

A brief history of the Web and the Internet – Web Data Mining – Information retrieval and Web search: Information retrieval Models-Relevance Feedback- Text and Web page Pre-processing – Inverted Index – Latent Semantic Indexing – Web Search – Meta-Search – Web Spamming.

MODULE II WEB LINK MINING 9

Social Network Analysis – Co-Citation and Bibliographic Coupling – Page Rank – HITS – Community Discovery. Web crawling – Basics – Implementation Issues – Universal Crawlers – Focused Crawlers – Evaluation – Crawler Ethics and Conflicts.

MODULE III STRUCTURED DATA EXTRACTION AND INTEGRATION 9

Wrapper Generation: Preliminaries- Wrapper Induction- Instance-Based Wrapper Learning ·- Automatic Wrapper Generation - String Matching and Tree Matching - Multiple Alignment - Building DOM Trees - Extraction Based on a Single and Multiple List Pages. Information Integration: Introduction to Schema Matching – Pre-Processing– Schema-Domain and InstanceLevel Matching – Combining Similarities.

MODULE IV WEB OPINION MINING 9

The Problem of Opinion Mining – Document Sentiment Classification – Aspect-based Opinion Mining – Opinion Search and Retrieval – Opinion Spam Detection.

MODULE V WEB USAGE MINING 9

Data Collection and Pre-Processing - Data Modeling for Web Usage Mining – Web Usage Pattern Analysis and Discovery - Recommender Systems and Collaborative Filtering – Query Log Mining.

TOTAL HOURS : 45

TEXT BOOKS:

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, Springer, Second Edition, 2012.
2. Soumen Chakrabarti, “Mining the Web – Discovering Knowledge from Hypertext Data”, Elsevier, 2002.

REFERENCE BOOKS

1. Guandong Xu,Yanchun Zhang, Lin Li, “Web Mining and Social Networking - Techniques and Applications”, Springer, 2017.
2. Federico Alberto Pozzi, Elisabetta Fersini,Enza Messina and Bing Liu, “Sentiment Analysis in Social Networks”, Morgan Kaufmann, 2017.

OUTCOMES:

Students who complete this course will be able to

- Acquire knowledge on Information Retrieval methods
- Analyze social networks and develop schemes to crawl, organize and index the web data
- Design wrappers and extract data from the web
- Understand the challenges and limitations of opinion mining techniques
- Identify and extract usage patterns in log data

CADY 363 DATA MINING AND DATA WAREHOUSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to

- Understand the basic concepts of Data mining, data quality and techniques for preprocessing of data.
- Explore the kinds of patterns that can be discovered by association rule mining.
- Impart the knowledge on how to implement classification models and algorithms.
- Learn to segregate groups with similar traits.
- Illustrate the various aspects of modeling and design of data warehouses.

MODULE I INTRODUCTION **9**

Data Mining: Introduction- Kinds of Data and Patterns–Major issues in data mining- Data Objects and attribute types – Statistical description of data - Measuring data similarity and dissimilarity. Data preprocessing: Overview-Data cleaning- Data integration –Data reduction-Data transformation and discretization.

MODULE II ASSOCIATION RULE MINING **9**

Basic concepts- Frequent itemset mining methods: Apriori algorithm- A pattern growth approach for mining frequent itemsets – Pattern evaluation methods- Mining multilevel, multi-dimensional space-constraint based frequent pattern mining.

MODULE III CLASSIFICATION **9**

Basic concepts- Decision Tree Induction - Bayes Classification Methods – Rule Based Classification-Model evaluation and selection - Techniques to improve classification accuracy – Support Vector Machines-Classification using frequent patterns.

MODULE IV CLUSTERING **9**

Cluster analysis- Partitioning methods- Hierarchical methods- Density based methods – Grid based methods – Model-Based Clustering Methods – Clustering High Dimensional Data- Constraint based Cluster Analysis – Introduction to outlier analysis -Data Mining Applications

MODULE V DATA WAREHOUSING 9

Data warehouse -basic concepts- Modeling – Design and usage- Implementation – Data generalization by Attribute-oriented induction approach – Data cube computation methods.

TOTAL HOURS : 45

TEXT BOOKS

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, 3rd Edition, Elsevier, 2012.

REFERENCES :

1. Margret H. Dunham, “Data Mining: Introductory and Advanced Topics”, 17th Edition, Pearson Education, 2013.
2. Charu C. Aggarwal, “Data Mining: The Textbook”, Kindle Edition, Springer, 2015.
3. Gupta G.K., “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Parteek Bhatia, “Data Mining and Data Warehousing-Principles and Practical Techniques”, Cambridge University Press, 2019.

OUTCOMES:

Students who complete this course will be able to

- Identify the key processes of data mining and knowledge discovery process.
- Generate patterns using association rule mining in large datasets.
- Compare and contrast various classifiers.
- Cluster similar objects in a multivariate data sets.
- Design a data warehouse with dimensional modeling.

CADY 364 DATA ANALYTICS AND VISUALIZATION L T P C

3 0 0 3

OBJECTIVES :

- Summarize and present data in meaningful ways.
- Select the appropriate clustering method depending on the data and information.
- Analyze the concept of regression.
- Understand and verify the underlying assumptions and analysis on labeled data.
- Conduct, present, and interpret common statistical analyses using R with basic theory and practical implementation details to solve real world problems.

MODULE I INTRODUCTION TO DATA AND MACHINE LEARNING 9

Importance of analytics and visualization with data abundance- Review of probability- statistics and random processes- Estimation theory- Machine learning- supervised and unsupervised learning- gradient descent- overfitting, regularization.

MODULE II UNSUPERVISED LEARNING & EVALUATION METHODS 9

Clustering techniques: K-means, Gaussian mixture models and expectation-maximization- agglomerative clustering- evaluation of clustering- Rand index, mutual information based scores, Fowlkes-Mallows index

MODULE III SUPERVISED LEARNING & REGRESSION 9

Supervised classification methods: K-nearest neighbor- naive Bayes- logistic regression- decision tree- support vector machine- Introduction to artificial neural networks (ANNs)- Regression: Linear models- ordinary least squares- ridge regression- LASSO- Gaussian Processes regression.

MODULE IV ANALYSING DATA 9

Normal distribution - Sampling - The Central Limit Theorem- One-Way Analysis of Variance - F-test for ANOVA - Evaluating Group Differences - Type I and Type II Errors- Issues with Multiple Comparisons Analysis for proportions- Analysis for proportions - Two-Sample Tests for Proportions

MODULE V DATA VISUALIZATION 9

Basic principles- categorical and continuous variables- exploratory graphical analysis- Creating static graphs- animated visualizations- loops, GIFs and Videos- Data visualization in Python and R Programming- Data Structures and examples.

TOTAL HOURS : 45

TEXT BOOKS:

1. Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie, The Elements of Statistical Learning, Springer, 2001.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer., 2006.
3. David G. Stork, Peter E. Hart, and Richard O. Duda, Pattern Classification (2nd edition), Wiley, 2000.
4. Edward Tufte, The Visual Display of Quantitative Information (2nd edition), Graphics Press, 2001.

REFERENCES :

1. Colin Ware, Information Visualization: Perception for Design (2nd edition), Morgan Kaufmann, 2004.
2. Alberto Cairo, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders, Pearson Education, 2013.
3. Nathan Yau, Data Points: Visualization That Means Something, Wiley, 2013
4. Charles D. Hansen and Chris R. Johnson, Visualization Handbook, Academic Press, 2004.
5. Will Schroeder, Ken Martin, and Bill Lorensen, The Visualization Toolkit: An Object-Oriented Approach to 3D Graphics, Kitware Inc. Publishers, 2004.

OUTCOMES :

Students who complete this course will be able to,

- The student will gain detailed knowledge about the goal and techniques of the data analysis and visualization process.
- The student will understand the steps in characterizing and understanding data and will be able to build effective predictive models.
- Apply suitable machine learning and/or visualization techniques and analyze

the results obtained to enable optimal decision-making.

- The student will be able to build models for data that has no labeled training data available: Unsupervised learning
- The student will be able to use software applications and able to build models in R Programming.

CADY 365 SOCIAL MEDIA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to:

- Understand human behaviour in social web and related communities.
- Familiarize the learners with the tools of social network analytics.
- Learn knowledge representation using Sentiment analysis.
- Implement the social media analytics tools.
- Explore the case studies of social media analytics.

MODULE I INTRODUCTION TO SOCIAL MEDIA ANALYTICS 9

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small and large organizations; Application of SMA. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, social network and web data and methods.

MODULE II SOCIAL NETWORK ANALYSIS 9

Introduction to Social Network Analysis (SNA): definition and origin, core features of the SNA, Foundation of social network analysis. Networks: nodes, edges, adjacency matrix, one and two-mode networks, node degree, centrality, betweenness, reach, cliques, and paths. Graph Mining: Community detection, Clustering, Community structure, Modularity, Overlapping communities.

MODULE III MODELLING 9

Predictive modeling: link/attribute prediction. Influence in Social networks. Sentiment Analysis, Recommendation in Social Networks: Collaborative Filtering, and Content based Recommendation Systems.

MODULE IV MINING COMMUNITIES IN SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms.

MODULE V VISUALIZATION AND CASE STUDIES 9

Social Networks Visualization, Processing and Visualizing Data, Influence Maximization, Social network analysis case studies: Twitter, Facebook, Last.fm, DBLP, and IMDB, Pilot project.

TOTAL HOURS : 45

TEXT BOOKS :

1. Gohar F. Khan “Seven Layers of Social Media Analytics:” Mining Business Insights from social media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data- 2015.
2. Mathew A. Russel “Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites”, Jan 2011-First edition.

REFERENCE BOOKS:

1. Tracy L. Tuten, Michael R. Solomon “Social Media Marketing”, SAGE Publications Ltd, 2015.
2. Ian McCulloh, Helen Armstrong and Anthony Johnson, “Social Network Analysis with Applications”, Wiley Publications, 2013
3. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.

OUTCOMES:

On completion of this course, students will be able to

- Predict human behaviour in social web and related communities.
- Apply statistical models in real time applications.
- Represent knowledge using Sentiment analysis.
- Make better business decisions by leveraging social media data.
- Apply visualisation techniques in social networks.

CADY 366 HEALTH CARE ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of this course is to

- This course aims to equip students with highly demanded health analytics skills to select, prepare, analyze, and easily interpret health data.
- This course also gives sound knowledge on statistical views to evaluate the operational data to improve outcomes in the current healthcare job market.
- This course will explain the Health care data analysis techniques and their operations.
- This course will illustrate the importance of Health care analytics with real-time case studies.
- Graduates of the Programme will be able to do the data analysis using advanced techniques to solve the complexity of health data.

MODULE I AN INTRODUCTION TO HEALTHCARE DATA ANALYTICS 9

Introduction-Healthcare in the Digital Era-The significance of predictive analytic in health care- Electronic Health Records -Health Data Overview-Clinical Data analysis (CAD)- Key Findings in CDA. The opportunities and challenges of data analytics in health care- Sensitivity of care decisions- Problematic data conventions.

MODULE II BASIC TECHNIQUES AND METHODS USED IN CLINICAL DATA ANALYSIS 9

Health data analytics methodology - Data Categorization-Data Preprocessing and Missing Data Imputation-Feature Extraction and Selection-Linear Regression-Evaluation and Validation- Brier Score - Accuracy and other Evaluation Metrics Based on Confusion Matrix –ROC(Receiver Operating Characteristic) Curve - C-index.

MODULE III ADVANCED DATA ANALYTICS FOR HEALTHCARE 9

Supervised Techniques -Unsupervised Techniques -Example Applications. Decision Trees Artificial Neural Networks-Cost Sensitive Learning-Advanced Prediction Models Multiple Instance Learning- Reinforcement Learning.

MODULE IV MANAGEMENT AND IT CHALLENGES IN HEALTH CARE SECTOR 9

Health care information system Standards-Security of health care information systems- Organizing information technology services- Efficiency of operational Management-IT governance and management. Management's role in major IT initiatives - Assessing and achieving value in health care information systems.

MODULE V CASE STUDY – HEALTH DATA ANALYTICS 9

Healthcare Repository Overview - Repositories Data Understanding based on the Disease selection-Data set fetching -Data preprocessing-Techniques Implementation-Model selection- Validation -Results and discussion.

TOTAL HOURS : 45

TEXT BOOKS:

1. Healthcare Analytics, From Data to Knowledge to Healthcare Improvement by John Wiley & Sons, Inc., Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada, 2016.
2. Machine Learning and AI for Healthcare ISBN-13 (pbk): 978-1-4842-3798-4 ISBN-13 (electronic): 978-1-4842-3799-1 ,Copyright © 2019 by Arjun Panesar,2019
3. Healthcare data analytics. Edited by. Chandank. Reddy. Detroit, Michigan, USA. Charu C. Aggarwal. IBM T. J. Watson Wayne State University 2019.
4. Karen A Wager, Frances Wickham Lee, John P Glaser, "Managing Health Care Information Systems: A Practical Approach for Health Care Executives", John Wiley, 2nd edition 2009.
5. Marion J. Ball, Charlotte Weaver, Joan Kiel ,"Healthcare Information Management Systems: Cases, Strategies, and Solutions", Springer, 2010, 3 rd. edition
6. Rudi Van De Velde and Patrice Degoulet, "Clinical Information Systems: A Component based approach", Springer 2005.
7. Kevin Beaver, Healthcare Information Systems, Second edition Best Practices, CRC Press, 2002.

REFERENCES :

1. Marion J. Ball Healthcare Information Management Systems: A Practical

Guide Springer-Verlag GmbH, 1995.

2. Challenges and Trends in Clinical Data Analytics, September 2020 DOI: 10.46243/jst.2020.v5.i4.pp348-360.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate the roles that data analyses serve in the Decision support system Identify and reference sources of public health data and information.
- Examine the accuracy, integrity, and comparability of health data.
- Interpret results of data analyses found in public health studies and research.
- Apply graphical and descriptive techniques commonly used to summarize public health data.
- Use current techniques and tools necessary for complex computing practices.
- Identify preferred methodological alternatives in situations where commonly used statistical methods are not appropriate.
- Use suitable architecture or platform on design and implementation with respect to performance.

CADY 367 R PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is to

- Understand the basics in R programming
- To know how R programming used for Big Data analytics
- To learn the need for Text Processing
- Understand and able to know the R programming from a statistical approach
- Learn and analyzing R with other languages

MODULE I INTRODUCTION 09

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorized if-then else – Vector Equality – Vector Element names.

MODULE II MATRICES, ARRAYS AND LISTS 09

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive list.

MODULE III DATA FRAMES 09

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R.

MODULE IV OBJECT ORIENTED PROGRAMMING IN R 09

S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots.

MODULE V INTERFACING 09

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

TOTAL HOURS : 45

TEXT BOOKS:

1 Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series, 2013.
2 Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2011.

REFERENCES:

1. Mark Gardener, “Beginning R – The Statistical Programming Language”, Wiley, 2013.
2. Robert Knell, “Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R”, Amazon Digital South Asia Services Inc, 2013.

OUTCOMES:

Students who complete this course will be able to

- Understand the basics in R programming in terms of constructs, control statements, string functions
- Understand the use of R for Big Data analytics
- Learn to apply R programming for Text processing
- Able to appreciate and apply the R programming from a statistical perspective
- Learn to make analysis with other languages

CADY 368 DECISION SUPPORT SYSTEM L T P C
3 0 0 3

OBJECTIVES:

The objectives of the course are to

- Introduce the concepts of Decision support system and Decision making.
- Learn the development methodologies of Computerized Decision Support system.
- Learn the process metrics involved in Designing CRM Solution methodologies.
- Understand the process metrics involved in Designing SCM Solution methodologies.
- Integrate the Management Domain expertise in designing the DSS to provide Business Intelligence.

MODULE I INTRODUCTION 9

Decision Support System: Definition - Configuration - Characteristics and Capabilities of DSS - Components of DSS – Subsystems: Data Management - Model Management- User Interface - Knowledge-Based Management - DSS Classification. Decision making System: Definition - Models and support – Decision making Phases.

MODULE II DESIGN AND DEVELOPMENT OF DECISION SUPPORT SYSTEM 9

Introduction - Traditional System Development Life cycle - Alternate Development Methodologies. Prototyping: DSS Development Methodology. DSS - Technology Levels and Tools - Development Platforms - Development Tool Selection – Team-Developed DSS - End User Developed DSS – Computerized Decision Support and Framework for Decision support - Computational Intelligence.

MODULE III CUSTOMER RELATIONSHIP MANAGEMENT 9

Introduction – Marketing – Communication with the Customer - Value of customer – CRM Technologies – CRM Software – CRM Problems and issues – Measuring CRM Success- CRM Tools - Analytical CRM – Operational CRM - e-CRM Solutions.

MODULE IV SUPPLY CHAIN MANAGEMENT 9

Supply Chain Definition – Benefits – Components – Supply chain and value chain – Decision making and the supply chain – supply chain problems and solutions - IT in Supply Chain - Agile Supply Chains – Supply chain forecasting.

MODULE V CASE STUDY 9

Intelligent Decision support system: Business Intelligence - Healthcare – Environmental Ecosystem – CRM system- Human resource Management process – Market research – Financial DSS.

TOTAL HOURS : 45

TEXT BOOKS:

1. Efraim Turban and Jay E. Aronson, Decision Support System and Intelligent Systems, Prentice Hall International, 7th Edition 2011.
2. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2016.
3. Francis Buttle, Customer Relationship Management: Concepts & Tools, Elsevier, 2004.
4. Sprague R.H. Jr and H.J. Watson: Decision Support Systems, 4th Edition, Prentice Hall, 1996.

REFERENCE BOOKS:

1. George M. Marakas, Decision Support Systems, 2nd Edition, Pearson Education, 2005
2. Janakiraman V. S and Sarukesi K, Decision Support Systems, Prentice Hall of India, 6th Edition, ISBN : 9789390669936

OUTCOMES:

Students who complete this course will be able to

- Design the computerized decision support system.
- Select the appropriate tool and methodologies to implement the DSS
- Implement CRM Decision Support System
- Implement SCM Decision Support System
- Provide Business Intelligence through Computerized DSS for different verticals.

CADY 369 PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES :

The objective of this course is:

- To learn, how to develop models to predict categorical and continuous outcomes, using techniques such as neural networks, decision trees, logistic regression, support vector machines and bayesian network models.
- To know the use of the binary classifier and numeric predictor nodes to automate model selection.
- To know about the various model advantage and disadvantage
- To study the combination of two models for improving prediction
- To learn and achieve reliable results for managing and coordinating in analytical process.

MODULE I INTRODUCTION TO DATA MINING 08

Introduction, what is Data Mining? Key Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

MODULE II INTRODUCTION TO ANALYTICS 08

Why do we need Analytics? - Analytics in decision making - Power of Analytics- Predictive Analytics - Analytics in Finance, Manufacturing, Healthcare, IT, Telecom, Supply chain- Digital Analytics, Prescriptive analytics.

MODULE III DATA UNDERSTANDING AND PREPARATION 10

Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

MODULE IV MODEL DEVELOPMENT & TECHNIQUES 10

Data Partitioning, Model selection, Model Development Techniques, Neural Networks, Decision Trees, Logistic Regression, Discriminant analysis, Support Vector Machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

MODULE V MODEL EVALUATION AND DEPLOYMENT 9

Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Metalevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

TOTAL HOURS : 45

TEXT BOOKS :

1. Dr. Anasse Bari, Mohamed Chaouchi, Tommy Jung, (2016) Predictive Analytics For Dummies, 2nd edition,(ISBN-108126567937)
2. Eric Siegel, (2016) Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die 2nd edition, Wiley (ISBN-13-978-1119145677)

REFERENCE BOOKS:

1. Dinov, ID. (2018) Data Science and Predictive Analytics: Biomedical and Health Applications using R, Springer (ISBN 978-3-319-72346-4).
2. John D. Kelleher , Brian Mac Namee, Aoife D'Arcy, (2020), Fundamentals of Machine Learning for Predictive Data Analytics, second edition, The MIT Press,(ISBN-10-0262044692).

OUTCOMES :

On completion of this course, students will be able to

- Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
- Compare the underlying predictive modelling techniques.
- Select appropriate predictive modelling approaches in different kind of problems.
- Apply predictive modelling approaches using a suitable package such as SPSS Modeller.
- Manage and coordinate the analytical process.

CADY 370	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

MODULE I INTRODUCTION TO IoT 9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

MODULE II IoT ARCHITECTURE 9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

MODULE III IoT PROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

MODULE IV BUILDING IoT WITH RASPBERRY PI & ARDUINO 9

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

MODULE V CASE STUDIES AND REAL-WORLD APPLICATIONS 9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities -

participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL HOURS : 45

TEXT BOOKS:

1. Bahga A, Madisetti V. Internet of Things: A hands-on approach. Vpt; 2014 Aug 9.
2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
5. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012

REFERENCES:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.
2. Hanes D, Salgueiro G, Grossetete P, Barton R, Henry J. IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press; 2017 May 30.
3. Perry Lea, “Internet of Things for Architects”, PACKT, 2018.

OUTCOMES:

- Develop web services to access/control IoT devices.
- Analyze various protocols for IoT
- Design a portable IoT using Rasperry Pi
- Deploy an IoT application and connect to the cloud
- Analyze applications of IoT in real time scenario