INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 25 Years Successfully

M.Sc.,Computer Science

Curriculum and Syllabus

Regulations 2021

(Based on Choice Based Credit System (CBCS)

and

Learning Outcomes based Curriculum Framework (LOCF))

Effective from the Academic year

2021-2022

Department of Computer Science

School of Computing Sciences

VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES

SCHOOL OF COMPUTING SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

VISION AND MISSION OF THE DEPARTMENT

VISION

Aims to provide quality education in the field of Computer Science with state of art facilities and handle quality research in association with industry and other Universities to produce well trained IT professionals to cater the need of society.

MISSION

- To provide knowledge through teaching and training in the field of Computer Science.
- To concentrate on teaching-learning, research, project and consultancy help to increase the growth of IT and IT Enabled Services.
- To train students to get best opportunities and tackle challenges in IT industry.
- To equip students with communication skill, Leadership quality, ability to work with team help to improve the society.
- To provide value based and technical oriented related students help to build the nation.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)

PEO1: Graduates are prepared to be employed in IT industries by providing expected Domain Knowledge.

PEO2: Graduates are provided with practical training, hands-on and project experience to meet the industrial needs.

PEO3: Graduates are motivated in career and entrepreneurial skill development to become global leaders.

PEO4: Graduates are trained to demonstrate creativity, develop innovative ideas and. to work in teams to accomplish a common goal.

PEO5: Graduates are addressed with social issues and guided to operate problems with Solution.

PROGRAMME OUTCOMES (PO)

PO1: Critical Thinking: Apply knowledge of Computer Science to identify, analyse problems and to provide effective solution in the area of Computing.

PO2: Computing Skills and Ethics: Analyse a problem, and identify and define the computing requirements appropriate to its solution.

PO3: Analytical skill: Ability to design, develop algorithms and provide software solutions to cater the industrial needs.

PO4: Modern Tool Usage: Use current techniques, skills, and tools necessary for computing practices

PO5: Employability Skills: Inculcate skills to excel in the fields of Information Technology and its Enabled services, Government and Private sectors, Teaching and Research.

PO6: Ethics: Insists ethical responsibilities, human and professional values and make their contribution to the society.

PO7: Self Directed and Life-long Learning: Engaged in lifelong learning to equip them to the changing environment and be prepared to take-up mastering programmes.

PO8: Individual and team work: Function effectively as an individual, and as a member or a leader in diverse team and multidisciplinary settings.

PO9: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO10:Project management and finance: Demonstrate knowledge and understanding of the problem and management principles and apply these to one's own work, as a member and engineering and management principles and apply these to one's own work, as a member.

PO11:Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO12: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PROGRAMMESPECIFIC OUTCOMES (PSO)

PSO1: Professionally trained in the areas of programming, multimedia, animation, web designing, networking and to acquire knowledge in various domain based electives.

PSO2: Abet students to communicate effectively and to improve their competency skills to solve real time problems.

PSO3: The ability to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

Board of Studies - List of Members

School of Computing Sciences

S.No	Name & Designation	Address	Role
1	Dr.P.Mayilvahanan Professor & Head	Department of Computer Science, School of Computing Sciences, VISTAS, Chennai.	Chairman
2	Dr. T. Velmurugan Associate Professor & Head	Department of Computer Science, DG Vaishnav College, Chennai.	Industry Expert (External Member)
3	Dr. P. Magesh Kumar Managing Director	Calibsoft Technologies Pvt Ltd., Chennai.	Academic Expert (External Member)
4	Mr.R. Balamurugan Software Engineer	SCOPUS Technologies Ltd., Chennai	Alumni Member
5	Dr.S.Prasanna Professor & Head	Department of Computer Applications, School of Computing Sciences, VISTAS, Chennai	Internal Member
6	Dr. T. Kamalakannan Professor & Head	Department of Information Technology, School of Computing Sciences, VISTAS, Chennai	Internal Member

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS)

CHOICE BASED CREDIT SYSTEM(CBCS)

AND

LEARNING OUTCOME CURRICULUM FRAMEWORK(LOCF)

M.Sc.,(Computer Science)- Regulations-2021

(Applicable to all the candidates admitted from the academic year 2021-22 onwards)

1. DURATION OF THE PROGRAMME

1.1. Two years (Four semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from July to November of each year and the even semesters from January to May of each year.

1.3. There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1. Candidates for admission to the first year of the Degree of Master of Computer Science shall be required to pass the UG degree Examinations (Academic Stream) conducted with Mathematics and Computer Science/Computer applications/IT/computer science based courses as a core accepted as equivalent thereof by the Syndicate of the Vels Institute of Science, Technology & Advanced Studies.

3. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

3.1. A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than three academic years and passed the examinations of all the four semesters prescribed earning a minimum of 90 credits as per the distribution given in for Part I, II, III and also fulfilled such other conditions as have been prescribed thereof.

4. COURSE OF STUDY, CREDITS AND SCHEME OF EXAMINATION

4.1. The Course Components and Credit Distribution shall consist Part I, II & III:

(Minimum number of Credits to be obtained)

Credit Assignment Each course is assigned certain number of credits based on the following:
Contact period per week CREDITS

1 Lecture Period - 1 Credit

1 Tutorial Period - 1 Credit

2 Practical Periods - 1 Credit

(Laboratory / Seminar / Project Work / etc.)

5. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

5.1. **Eligibility:** Students shall be eligible to a subsequent semester only if they earn sufficient attendance as prescribed there by the Board of Management from time to time.

5.2. **Attendance:** All Students must earn 60% and above of attendance for appearing for the University Examination. (Theory/Practical)

5.3. **Condonation of shortage of attendance:** If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 60%) after collecting the prescribed fee towards the condonation of shortage of attendance should be remitted to the University.

5.4. **Non-eligibility for condonation of shortage of attendance:** Students who have secured less than 65 % but more than 50 % of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the program

5.5. **Detained students for want of attendance:** Students who have earned less than 50% of attendance shall be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the University from time to time.

5.6. **Condonation of shortage of attendance for married women students:** In respect of married women students undergoing UG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor together with the attendance details shall be forwarded to the university to consider the condonation of attendance mentioning the category.

5.7. **Zero Percent (0%) Attendance:** The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the University immediately to rejoin the program.

6. EXAMINATION AND EVALUATION

6.1. Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

6.2. Marks for Internal and End Semester Examinations for PART I, II, III

6.2.1. There shall be no passing minimum for Internal.

6.2.2. For external examination, passing minimum shall be 50% [Fifty Percentage] of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-Voce.

6.2.3. In the aggregate [External/Internal] the passing minimum shall be of 50%.

6.2.4. He / She shall be declared to have passed the whole examination, if he / she passes in all the papers and practical wherever prescribed as per the scheme of the examinations by earning 90 CREDITS in Part I, II, III.

7. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMS TO QUALIFY FOR A DEGREE

7.1. A Student who for whatever reasons is not able to complete the programs within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span = N + 2 years for the completion of programme)

8. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Academic Council with the approval of the Board of Management.

Vels Institute of Science and Technology and Advanced studies (VISTAS)

M.Sc.,(Computer Science)

Courses of Study and Scheme of Assessment

M.Sc.,(Computer Science) Course Components

Component	I Sem	II Sem	III Sem	IV Sem	Total Credits
Core Courses	14	16	14	14	58
Ability Enhancement Courses (AEC)	-	-	-	-	-
Discipline Specific Elective(DSE)&Generic Elective(GEC)	8	4	8	4	24
Skill enhancement Course(SEC)& SI	2	4	2	-	8
Total Credits	**24**	**24**	**24**	**18**	**90**

2. Learning Outcomes based Curriculum Framework

Table of Contents

1. Introduction

Computer Science (CS) has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain.

Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Universities and other HEIs introduced programmes of studies in computer science as this discipline evolved itself to a multidisciplinary discipline. Information Technology is growing rapidly. Increasing applications of computers in almost all areas of human endeavour has led to vibrant industries with concurrent rapid change in technology. Unlike other basic disciplines, developing core competency in this discipline that can be reasonably stable becomes a challenge. In India, it was initially introduced at the Master (postgraduate) level as MCA and M.Tech. Later on, engineering programmes such as B.Tech and B.E in Computer Science & Engineering and in Information Technology were introduced in various engineering College/Institutions to cater to the growing demand for trained engineering manpower in IT industries. Parallelly, BSc and MSc programmes with specialisation in Computer Science were introduced to train manpower in this highly demanding area. M.Sc in Computer Science are being planned and introduced in different colleges and institutions.

Computer Science education at PG level (+2) will result in earning Mater of Science degree in CS. Students so graduated, in CS in PG level leading to research as well as R&D, can be employable at IT industries, or can pursue a teachers' training programme such Bed in Computer Education, or can adopt a business management career. M.Sc(CS) aims at laying a strong foundation of CS at an advanced stage of the career along with two other branch such as M.C.A, M.Tech, B.E/B.Tech etc. There are several employment opportunities and after successful completion of an PG programme in CS, graduating students can fetch employment directly in companies as Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

The Learning Outcome-based Curriculum Framework in Computer Science is aimed at allowing flexibility and innovation in design and development of course content, in method of imparting training, in teaching learning process and in assessment procedures of the learning outcomes. The emphasis in computer science courses, in outcome-based curriculum framework, help students learn solving problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages.

Many of the learning outcomes of Computer Science can be achieved only by programming a computer for several different meaningful purposes. All students must, therefore, have access to a computer with a modern programming language installed. The computer science framework does not prescribe a specific language. The teacher and students will decide which modern programming languages students will learn. More importantly, students will learn to adapt to changes in programming languages and learn new languages as they are developed.

The present Learning Outcome-based Curriculum Framework for Master degrees in CS is intended to facilitate the students to achieve the following.

- To develop an understanding and knowledge of the advanced theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation.
- To develop the ability to use this knowledge to analyse new situations
- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.

- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems
- To learn skills and tools like mathematics, statistics, physics and electronics to find the solution, interpret the results and make predictions for the future developments.

2. Curriculum Planning- Learning Outcomes-basedApproach

2.1 Nature and Extent of the M.Sc.,(Computer Science)Programme

The Master programs in Computer Science builds on science-based education at UG level. The +2 senior secondary school education aims and achieves a sound grounding in understanding the basic scientific temper with introduction to process of computation by introducing some programming languages. This prepares a young mind to launch a rigorous investigation of exciting world of computer science.

Framing and implementation of curricula and syllabi is envisaged to provide an understanding of the basic connection between theory and experiment and its importance in understanding the foundation of computing. This is very critical in developing a scientific temperament and to venture a career which a wide spectrum of applications as well as theoretical investigations. The undergraduate curriculum provides students with theoretical foundations and practical experience in both hardware and software aspects of computers. The curriculum in computer science is integrated with courses in the sciences and the humanities to offer an education that is broad, yet of enough depth and relevance to enhance student employment opportunities upon graduation. As a Bachelor's degree program, the curriculum is based on the criterion that graduates are expected to function successfully in a professional employment environment immediately upon graduation.

The Master program in Computer Science is presently being offered though the courses designed for granting the following degrees by various colleges and universities in India. All the courses are of 2-year duration spread over Four semesters.

M. Sc. ,(Computer Science)

M.Sc Computer Science) is a advanced level Master Programme.

Types of Courses

Core Course (CC)

A core course is a mandatory course required in degree. **Core course** of study refers to a series or selection of courses that all students are required to complete before they can move on to the next

level in their education or earn a diploma. The general educational purpose of a core course of study is to ensure that all students take and complete courses that are academically and culturally essential. These are the courses that teach students the foundational knowledge and skills they will need in securing the specific degree or diploma. The core courses are designed with an aim to cover the basics that is expected of a student to imbibe in that particular discipline. Thus, a course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. The present document specifies the core courses for B.Sc. The courses (papers, as referred popularly) under this category are going to be taught uniformly across all universities with 30% deviation proposed in the draft. The purpose of fixing core papers is to ensure that all the institutions follow a minimum common curriculum so that each institution/ university adheres to common minimum standard.

Electives

Generally a course which can be chosen from a pool of courses and which maybe very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course. Different types of elective courses mandated in the present framework are the following.

- Domain Specific Elective(DSE)
- Generic Elective(GE)

Discipline Specific Elective(DSE)

Elective courses offered under the main discipline/subject of study are referred to as Discipline Specific Elective. The list provided under this category are suggestive in nature and HEI has freedom to suggest its own papers under this category based on their expertise, specialization, requirements, scope and need. The University/Institute may also offer discipline related elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

Generic Elective (GE)

An elective course chosen from another discipline/subject, with an intention to seek exposure beyond discipline/s of choice is called a Generic Elective. The purpose of this category of papers is to offer the students the option to explore disciplines of interest beyond the choices they make in Core and Discipline Specific Elective papers. The list provided under this category are suggestive in nature and HEI can design its own papers under this category based on available expertise, specialization, and contextual requirements, scope and need.

Dissertation/Project

An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his/her own with an advisory support by a teacher/faculty member is called dissertation/project.

Skill Enhancement Courses (SEC)

SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc. SEC are 3courses for General Master programmes. These courses may be chosen from a pool of courses designed to provide skill-based knowledge and should contain both theory and lab/hands-on/training/field work.

The main purpose of these courses is to provide students life-skills in hands-on mode to increase their employability. The list provided under this category are suggestive in nature and each university has freedom to suggest their own papers under this category based on their expertise, specialization, requirements, scope and need.

Practical/Tutorial

For each core course and DSE course there will be one practical. The list of practical provided is suggestive in nature and each university has the freedom to add/subtract/edit practical from the list depending on their faculty and infrastructure available. Addition will however be of similar nature.

2.2 Aims of Master of Science Programmes in Computer Science

The Master of Science degree in Computer Science emphasizes problem solving in the context of algorithm development and software implementation and prepares students for effectively using modern computer systems in various applications. The curriculum provides required computer science courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering; as well as elective courses in artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other current topics in computer science.

The aim of this Master degree is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners. The purpose of the M.Sc programs in computer science are twofold: (1) to prepare the student for a position involving the design, development and implementation of computer software/hardware, and (2) to prepare the student for entry into a program of Research study in computer science/engineering and related fields.

The Master of Science program with Computer Science as one subject (M.Sc with CS) focus on the concepts and techniques used in the design and development of software systems. Students in this program explore the conceptual underpinnings of Computer Science -- its fundamental algorithms, programming languages, operating systems, and software engineering techniques. In addition, students choose from a rich set of electives that includes data science, computer graphics, artificial intelligence, database systems, computer architecture, and computer networks, among other topics. A generous allotment of free electives allows students to combine study in computer science with study in auxiliary fields to formulate a program that combines experiences across disciplines.

3. Graduate Attributes

Graduate Attributes (GA) are the qualities, skills and understandings that students should develop during their time with the HEI. These are qualities that also prepare graduates as agents of social good in future. Graduate Attributes can be viewed as qualities in following subcategories.

- Knowledge of the discipline
- Creativity
- Intellectual Rigour
- Problem Solving and Design
- Ethical Practices
- Lifelong Learning
- Communication and Social Skills

Among these attributes, categories attributes under Knowledge of the Discipline are specific to a programme of study.

3.1 Knowledge of Discipline of CS

Knowledge of a discipline is defined as "command of a discipline to enable a smooth transition and contribution to professional and community settings. This Graduate Attribute describes the capability of demonstrating comprehensive and considered knowledge of a discipline. It enables students to evaluate and utilise information and apply their disciplinary knowledge and their professional skills in the workplace.

3.1.a. Creativity

Creativity is a skill that underpins most activities, although this may be less obvious in some disciplines. Students are required to apply imaginative and reflective thinking to

their studies. Students are encouraged to look at the design or issue through differing and novel perspectives. Creativity allows the possibility of a powerful shift in outlook and enables students to be open to thinking about different concepts and ideas.

3.1.b. Intellectual Rigour

Intellectual Rigour is the commitment to excellence in all scholarly and intellectual activities, including critical judgement. The students are expected in having clarity in thinking. This capability involves engaging constructively and methodically when exploring ideas, theories and philosophies. It also relates to the ability to analyse and construct knowledge with depth, insight and intellectual maturity.

3.1.c. Problem Solving and Design

Problem solving skills empower students not only within the context of their programmes, but also in their personal and professional lives. Many employers cite good problem solving skills as a desired attribute that they would like graduates to bring to the workplace. With an ability to seek out and identify problems, effective problem solvers are able to actively engage with a situation, think creatively, to consider different perspectives to address identified challenge, to try out possible solutions and subsequently evaluate results as a way to make decisions. Through this process they can consolidate new and emergent knowledge and develop a deeper understanding of their subject discipline.

3.1.d. Ethical Practices

Ethical practice is a key component of professionalism and needs to be instilled in curricula across courses. When operating ethically, graduates are aware that we live in a diverse society with many competing points of view. Ethical behaviour involves tolerance and responsibility. It includes being open-minded about cultural diversity, linguistic difference, and the complex nature of our world. It also means behaving appropriately towards colleagues and the community and being sensitive to local and global social justice issues.

3.1.e. Life-Long Learning

The skill of being a lifelong learner means a graduate is open, curious, willing to investigate, and consider new knowledge and ways of thinking. This flexibility of mind means they are always amenable to new ideas and actively seek out new ways of learning or understanding theworld.

3.1.f. Communication and Social Skills

The ability to communicate clearly and to work well in a team setting is critical to sustained and successful employment. Good communication and social skills involve the ability to listen to, as well as clearly express, information back to others in a variety of ways - oral, written, and visual - using a range oftechnologies.

3.1.g. Self-Management

Graduates must have capabilities for self-organisation, self-review, personal development and life-long learning.

3.2 LIST OF GRADUATE ATTRIBUTES for M.Sc,.(CS)

Afore-mentioned GAs can be summarized in the following manner.

GA 1. A commitment to excellence in all scholarly and intellectual activities, including critical judgement

GA 2. Ability to think carefully, deeply and with rigour when faced with new knowledge and arguments.

GA 3. Ability to engage constructively and methodically, when exploring ideas, theories and philosophies

GA 4. Ability to consider other points of view and make a thoughtful argument

GA 5. Ability to develop creative and effective responses to intellectual, professional and social challenges

GA 6. Ability to apply imaginative and reflective thinking to their studies

GA 7. Commitment to sustainability and high ethical standards in social and professional practices.

GA 8. To be open-minded about cultural diversity, linguistic difference, and the complex nature of our world

GA 9. Ability to be responsive to change, to be inquiring and reflective in practice, through information literacy and autonomous, self-managed learning.

GA 10. Ability to communicate and collaborate with individuals, and within teams, in professional and community settings

GA 11. Ability to communicates effectively, comprehending and writing effective reports and design documentation, summarizing information, making effective oral presentations and giving and receiving clear oralinstructions

GA 12. Ability to demonstrates competence in the practical art of computing in by showing in design an understanding of the practical methods, and using modern design tools competently for complex real-life IT problems

GA 13. Ability to use a range of programming languages and tools to develop computer programs and systems that are effective solutions to problems.

GA 14. Ability to understand, design, and analyse precise specifications of algorithms, procedures, and interaction behaviour.

GA 15. Ability to apply mathematics, logic, and statistics to the design, development, and analysis of software systems

GA 16. Ability to be equipped with a range of fundamental principles of Computer Science that will provide the basis for future learning and enable them to adapt to the constant

rapid development of the field.

GA 17. Ability of working in teams to build software systems.

GA 18. Ability to identify and to apply relevant problem-solving methodologies

GA 19. Ability to design components, systems and/or processes to meet required specifications

GA 20. Ability to synthesis alternative/innovative solutions, concepts and procedures

GA21.Ability to apply decision making methodologies to evaluate solutions for efficiency, effectiveness and sustainability

GA 22.A capacity for self-reflection and a willingness to engage in self-appraisal

GA 23. Open to objective and constructive feedback from supervisors and peers

GA 24. Able to negotiate difficult social situations, defuse conflict and engage positively in purposeful debate.

4. Qualification Descriptors

Qualification descriptors are generic statements of the outcomes of study. Qualification descriptors are in two parts. The first part is a statement of outcomes, achievement of which a student should be able to demonstrate for the award of the qualification. This part will be of interest to those designing, approving and reviewing academic programmes. They will need to be satisfied that, for any programme, the curriculum and assessments provide all students with the opportunity to achieve, and to demonstrate achievement of, the outcomes. The second part is a statement of the wider abilities that the typical student could be expected to have developed. It will be of assistance to employers and others with an interest in the general capabilities of holders of the qualification. The framework has the flexibility to accommodate diversity and innovation, and to accommodate new qualifications as the need for them arises. It should be regarded as a framework, not as astrait jacket.

4.1 Qualification Descriptor for M.Sc.,(CS)

On completion of M.Sc. with Computer Science, the expected learning outcomes that a student should be able to demonstrate are the following.

QD-1. Fundamental understanding of the principles of Computer Science and its connections with other disciplines

QD-2. Procedural knowledge that creates different types of professionals related to Computer Science, including research and development, teaching and industry, government and public service;

QD-3. Skills and tools in areas related to computer science and current developments in the academic field of study.

QD-4. Use knowledge, understanding and skills required for identifying problems and issues, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, and their application, analysis and evaluation using methodologies as appropriate to Computer Science for formulating solutions.

QD-5. Communicate the results of studies undertaken in Computer Science accurately in a range of different contexts using the main concepts, constructs and techniques

QD-6. Meet one's own learning needs, drawing on a range of current research and development work and professional materials

QD-7. Apply Computer Science knowledge and transferable skills to new/unfamiliar contexts,

QD-8. Demonstrate subject-related and transferable skills that are relevant to industry and employment opportunities.

5. Programme Learning Outcomes

These outcomes describe what students are expected to know and be able to do by the time of graduation. They relate to the skills, knowledge, and behaviours that students acquire in their graduation through the program

5.1 Programme Learning Outcomes for M.Sc.,(CS)

The Master of Science with Computer Science (MSc with CS) program enables students to attain, by the time of graduation:

PLO-A. Demonstrate the aptitude of Computer Programming and Computer based problem solvingskills.

PLO-B. Display the knowledge of appropriate theory, practices and tools for the specification, design,implementation

PLO-C. Ability to learn and acquire knowledge through online courses available at different MOOCProviders.

PLO-D. Ability to link knowledge of Computer Science with other two chosen auxiliary disciplines ofstudy.

PLO-E. Display ethical code of conduct in usage of Internet and Cybersystems.

PLO-F. Ability to pursue higher studies of specialization and to take up technical employment.

PLO-G. Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.

PLO-H. Ability to operate, manage, deploy, configure computer network, hardware, software operation of anorganization.

PLO-I. Ability to present result using different presentation tools.

PLO-J. Ability to appreciate emerging technologiesand tools.

6 Teaching-Learning Process

The teaching-learning process should be in-line with the course objective and outcomes. Teaching has to ensure that the suggested outcomes are ensured for each course and overall programme. Teaching-aids should be used wherever required to facilitate proper and impactful learning. Blended learning is recommended with the use of MOOC platforms and classroom teaching. To meet the set objectives of the course and enable students achieve the expected outcomes of the course the teaching-learning process should be appropriately chosen. Though the teachers are best positioned to create innovative models suitable for teaching the course, certain well accepted and widely tested processes are suggested to achieve the desired outcomes

CLASSROOM TEACHING - Regular classroom and face to face teaching and tutorials can be primarily used for imparting theoretical foundations of Computer Science. Applications of the same may be explained from time to time so that the student can appreciate the theory.

LABORATORY - Lab exercises in programming and usage of package / software tools should be made mandatory and integral part. Open source software/Packages should be preferred over proprietary tools wherever available.

SEMINARS - Guest lectures and seminars involving industry experts and eminent teachers should be arranged to help the students understand the practices in the industry and developments in the field.

MOOCS - Teacher should choose appropriate lecture materials and videos on similar courses available online through Massive Open Courses Online in the world wide web (such as NPTEL) to provide good perspective of the course and usecases and promote blended learning.

PROJECT - Wherever possible the laboratory assignments can be designed in the form of a mini project. For example, the database course lab assignments can be designed to build a complete system for library management. Similarly, summer/ Semester breaks can be utilized for guiding students to develop live projects with industry orientation/ industry problem. Teamwork work should be encouraged,

ASSIGNMENTS - Home assignments should be designed to make student collect information from various sources and solve unfamiliar problems and make comparisons of solutions

MAJOR PROJECT - The major project should be defined based on the student proposals keeping in mind that opportunity to demonstrate the knowledge and skills gained during the course. One-One mentoring support should be provided.

7 .Assessment Methods

The committee recommends that assessment should be viewed not only merely as a testing by the institution to evaluate the students' progress, but also as a valuable tool for a student to learn what is expected of him/her, where their level of knowledge and skill is lacking, and perhaps most importantly, what he/she could do to improve these levels with the valuable inputs of the lecturers. Assessment methods are the strategies, techniques, tools and instruments for collecting information to determine the extent to which students demonstrate desired learning outcomes.

In the Master's programmes leading to degrees such as M.Sc Computer Science , the assessment and evaluation methods focus on testing the conceptual understanding of the basic ideas of computer hardware and software, development of programming skills and experimental techniques, retention and ability to apply the knowledge acquired to real-life applications, and to solve new problems and communicate the results and findings effectively.

Based on the Learning Objectives defined for each course as proposed in detail, assessment methods can be designed to monitor the progress in achieving the Learning Objectives during the course and test the level of achievement at the end of the course. Several methods can be used to assess student learning outcomes. Relying on only one method to provide information about the program will only reflect a part of students' achievement.

Modular Assessment As the courses are broken up into a smaller more cohesive learning outcomes a module will consist of a number of these smaller, finer grained assessments of which the majority can be considered to be formative assessments that aid the learning process rather than assessments aimed at solely being used to evaluate the student. Continuous Assessment The continuous assessment occurs on a regular and continuous basis, it is an ongoing formative and summative process, involves the monitoring of students, is integrated with teaching, involves a systematic collection of marks or grades into a final score, may be used to determine the students' final grades.

Direct methods of assessment ask students to demonstrate their learning while indirect methods ask students to reflect on their learning. Tests, essays, presentations, etc. are generally direct 86methods of assessment, and indirect methods include surveys and interviews. For each Learning Objective, a combination of direct and indirect assessment methods should be used.

Formative Assessment While formative assessment is to gather feedback from formal or informal processes that can be used by the instructor and the students to gather evidence for the purpose of improving learning, summative assessment measures the level of success or proficiency that has been obtained at the end of an instructional unit, by comparing it against some standard or

benchmark. Nevertheless, the outcome of a summative assessment can be used formatively when students or faculty use the results to guide their efforts and activities in subsequent courses.

Daily programming assignments or home-assignments is a good way of implementing formative assessment and gives an idea of how well the students understood and could apply each programming concept. Another way of formative assessment can be that at the end of each class period, a student response system can be used to ask students one or more questions about the topic taught on that day. Regular tutorial Assignment, Term-paper, Seminar Presentation, Surprise Quizzes, Open-book Quizzes should be adopted for formative assessments.

M.Sc. COMPUTER SCIENCE CURRICULUM

Total number of Credits: 90

Category	Code No	Course	Hours/Week				Maximum Marks		
			Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER I									
Core	21CMCS11	Linux Programming	4	0	0	4	40	60	100
Core	21CMCS12	Design and Analysis of Algorithm	4	0	0	4	40	60	100
Core	21CMCS13	Scripting Language	3	0	4	4	40	60	100
Core	21PMCS11	Linux Programming Lab	0	0	4	2	40	60	100
DSE	21DMCS--	DSE 1	4	0	0	4	40	60	100
DSE	21DMCS--	DSE 2	4	0	0	4	40	60	100
SEC		Soft Skill1/ Sector Skill Course	2	0	0	2	40	60	100
			21	**0**	**8**	**24**			
SEMESTER II									
Core	21CMCS21	Advanced DBMS	4	0	0	4	40	60	100
Core	21CMCS22	ASP .NET Programming	4	0	0	4	40	60	100
Core	21CMCS23	Pattern Recognition	4	0	0	4	40	60	100
Core	21PMCS21	Advanced DBMS Lab	0	0	4	2	40	60	100
Core	21PMCS22	ASP .NET Programming Lab	0	0	4	2	40	60	100
DSE	21DMCS--	DSE 3	4	0	0	4	40	60	100
SI		Internship	0	0	4	2	40	60	100
SEC		Soft Skill2/ Sector Skill Course	2	0	0	2	40	60	100
			18	**0**	**12**	**24**			
SEMESTER III									
Core	21CMCS31	Natural Language Processing	4	0	0	4	40	60	100
Core	21CMCS32	Deep Learning	4	0	0	4	40	60	100
Core	21CMCS32	Mobile Application Development	3	0	4	4	40	60	100
Core	21PMCS31	Mini Project	0	0	4	2	40	60	100
DSE	21DMCS31	DSE 4	4	0	0	4	40	60	100
DSE	21DMCS31	DSE 5	4	0	0	4	40	60	100
SEC		Soft Skill 3/ Sector Skill Course	2	0	0	2	40	60	100
			21	**0**	**8**	**24**			
SEMESTER IV									
Core	21CMCS41	Internet of Things	4	0	0	4	40	60	100
GE	21GMCS41	Generic Elective-I	4	0	0	4	40	60	100
Core	21PMCS41	Project Work	0	0	20	10	40	60	100
			8	**0**	**20**	**18**			

CA - Continuous Assessment, SEE - Semester End Examination

List of Discipline Specific Elective Courses

Theory of Automata
Computational Intelligence
Block Chain Technology
Cloud Computing
Software Quality Assurance
Cryptography and its Applications
Big Data Analytics
Parallel and Distributed Computing System
Neural Networks
Advanced Compiler Design
Mobile Computing
R Programming
Artificial Intelligence
Embedded System
Security Issues in Machine Learning

List of Generic Elective Courses

Human Resource Management
Social Networks
Geographical Information System
Technical Writing in Computer Science

List of Skill Enhancement Courses

Soft Skill-I
Soft Skill-II
Soft Skill-III

SEMESTER-I

21CMCS11 LINUXPROGRAMMING 4 0 04

Course Objective

To familiarize students with the Linux environment, to learn the fundamentals of shell scripting/programming, to manage basic Linux administration, to explain execution procedure, debugging and kernel structure.

Course Outcome

UNITI LINUX OPERATINGSYSTEMS 12

Introduction – History of UNIX and Linux – System Features – Software Features – Differences between Linux and Other Operating System – hardware requirements - sources of Linux Information Linux Startup and Setup: User accounts – Accessing the Linux system – Linux Commands.

UNIT II THE SHELL 12

The command line – Command line Editing - Creating files using the vi editor: Text editors – The vi editor - Managing Documents: Locating files in LINUX – Standard files – Redirection – Filters – Pipes - Ending Processes: ps and kill - The C Shell: Command Line Editing and - C Shell Command Line Editing - C Shell History - The TCSH Shell - TCSH Command Line Completion - TCSH History Editing - TheZ-shell

UNIT III LINUXFILE STRUCTURE 12

Linux file types – File structures – managing Files - Managing Directories – File and Directory operation – File Management Operation : File and Directorypermissions.

UNIT IV THE SHELL SCRIPTSANDPROGRAMMING 12

Shell Variables – Definition of Variables - Variable values - Strings – Values from Linux commands – Shell Scripts – User Defined commands - Executing Scripts –Script Arguments – Environment Variables and Subshells Variable – Control Structures – Test operations – Conditional Control Structures –Test Expressions – Shell conditions – Shell loops – Simple Programs using shell scripts.

UNIT V LINUX SOFTWARES 12

Software Management -Software Package Types - Red Hat Package Manager(RPM) - Debian - Installing Software from Compressed Archives: .tar.gz - Command and ProgramDirectories

- Office and Database Applications - Running Microsoft Office on Linux: Cross Over OpenOffice.org - KOffice - KOffice Applications - GNOME Offi ce - Document Viewers - PDAAccess-DatabaseManagement-SQLDatabases(RDMS)-XbaseDatabases-Editors
- GNOME Editor: Gedit - K DesktopEditors.

Total : 60 Hours

Course Outcomes:

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

CO-1: Evaluate different types of editors in Linux using for shell programming.

CO-2: Analyze Directories and file and directory permissions.

CO-3: Apply necessary tools and methods for Linux application development and learn about the features and techniques that are unique to Linux.

CO-4: Understand about Linux File Structures and Managing files.

CO-5: Understand all the Linux utilities, and implement shell scripting. Write shell scripts to automate various tasks.

Text Books:

1. Richard Petersen, "Linux: The Complete Reference", Sixth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi, Edition2008.
2. Neil Matthew, Richard stones, Alan Cox, "Beginning Linux Programming", Wrox Publication.

Reference Books:

1. NIIT ,"Operating System LINUX", PHI, Eastern Economy Edition, 2006

Web Sources:

1. www.youtube.com/watch?v=wBp0Rb-ZJak
2. www.javatpoint.com/linux

21CMCS12 DESIGN AND ANALYSIS OF ALGORITHM 4 0 0 4

Course Objective:

This course gives insight into the design and analysis for divide and conquer, sorting, dynamic programming, backtracking, Dynamic Programming, knapsack, tree vertex splitting, biconnected problems.

UNIT-I:INTRODUCTION **12**

Introduction - Definition of Algorithm – Pseudo Code Conventions – Recursive Algorithms– Time And Space Complexity –Big-"Oh" Notation – Practical Complexities – Randomized Algorithms – Repeated Element – Primarily Testing.

UNIT- II: DIVIDE AND CONQUER **12**

Divide And Conquer: General Method –Binary Search – Finding the Maximum and Minimum- Merge Sort-Quick Sort- Strassen's Matrix Multiplication.

UNIT- III:GREEDY METHOD **12**

Greedy Method: General Method-Knapsack Problem-Tree Vertex Splitting-Job Sequencing with Deadlines-Minimum Cost Spanning Trees- Prim's Algorithm- Kruskal's Algorithm-Single Source Shortest Paths.

UNIT- IV: DYNAMIC PROGRAMMING **12**

Dynamic Programming: General Method-Multistage Graph-All Pair Shortest Path-Optimal Binary Search Trees-0/1 Knapsack -Traveling Sales Person Problem-Flow Shop Scheduling.

UNIT- V:BACKTRACKING **12**

Backtracking: General Method, 8- Queen's Problem-Sum of Subsets-Graph Coloring-Hamilton Cycles-Knapsack Problem. Branch and Bound: The Method-0/1 Knapsack Problem-Traveling Salesmen Problem.

Total :60 Hrs

Course Outcomes:

At the End of the course, the Student will be able to:

CO-1: Analyze the Complexity and performance of algorithms.

CO-2: Analyze Quick sort, Merge sort algorithm, BFS and DFS Algorithms.

CO-3: Apply appropriate algorithm design techniques for solving problems.

CO-4: Understand how the choice of data structures and the algorithm design methods impact the performance of programs.

CO-5: Understand the set of rules design methods in Greedy Method.

Text book:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Fundamentals of Computer Algorithms", Second Edition, University Press, 2013

Reference books:

1. Manas Ranjan Kabat, DESIGN AND ANALYSIS OF ALGORITHMS, PHI Learning Pvt. Ltd., 2013.

2. Jean-Paul Trembley, Paul.G.Sorenson, "Introduction to Data structures with Applications", Tata McGraw Hill, and Second Edition, 2010.

3. G. Brassard and P. Bratley, Fundamentals of Algorithms, PHI, New Delhi,1997.

Web Sources:

1. www.guru99.com
2. www.youtube.com/watch?v=D6Q_wHrzxDs

21CMCS013 SCRIPTING LANGUAGES 3 0 4 4

Course Objective: Student will understand Scripting languages and its purposes. The course will cover theoretical aspects of the subject with suitable programs through scheduled lectures. The course will cover the Client Side and Server Side Scripting Languages.

UNIT I HTML **12**

Internet Basics- Introduction to Scripting Languages- Client Side and Server Side Scripting Languages- - Introduction to HTML - List - Creating Table - Linking document - Frames - Graphics to HTML Doc - Style sheet - Style sheet basic - Add style to document - Creating Style sheet rules - Style sheet properties - Font - Text - List - Color and background color - Box - Display properties.

UNIT II VB SCRIPT **12**

Introduction to VBScript - Adding VBScript Code to an HTML Page - VB Script Basics - VBScript Data Types - VBScript Variables - VBScript Constants -VBScript Operators – mathematical- comparison-logical - Using Conditional Statements - Looping Through Code - VBScript Procedures – type casting variables - math functions – date functions – string functions – other functions - VBScript Coding Conventions - Dictionary Object in VBScript - Err Object

UNIT IIIJAVA SCRIPT **12**

Introduction to Javascript – Advantages of Javascript – Javascript syntax - Data type –Variable - Array – Operator & Expression – Looping – control structures - Constructor Function – user defined function Dialog Box .

UNIT IV PERL **12**

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT V CGI **9**

CGI and Scripting languages: Introduction to CGI, Alternative Technologies, The Hypertext Transport Protocol, URLs, HTTP, Browser Requests, Server Responses, Proxies, Content Negotiation, The Common Gateway Interface, The CGI Environment, Environment Variables, CGI Output, Forms and CGI, Sending Data to the Server.

Practical:

1. Create a table to show your class time table using HTML.
2. Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.
3. Create a webpage with HTML describing your department use paragraph and list tags.
4. Write a VBScript code that accepts the length, breadth and height and displays the area of a rectangle.
5. Create a form that has an e-mail field and write VBScript code for validation of the email address.
6. Write a java script program to test the first character of a string is uppercase or not.
7. Write a java script for loop that will iterate from 0 to 15 for each iteration, it will check if the current number is odd or even, and display a message to the screen.
8. Write a java script program which computes the average marks of the 10 student's then average is used to determine the corresponding grade.
9. Write a Perl script to substitute a word, with another word in a string.
10. Write a Perl script to validate IP address and email address.
11. Write a Perl script to print the file in reverse order using command line arguments
12. Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc

Total: 60 Hours

Course Outcomes:

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

CO-1: Create applications by using the concepts like Java Script, HTML , PERL.

CO-2: Create web scraping scripts to programmatically obtain data and content from web pages

CO-3: Evaluate techniques used to create scripts for automating system administrative tasks.

CO-4: Analyze many of the modern and way cool language features that show up frequently in scripting languages

CO-5: Have understanding of server side scripting with PERL & CGI language.

Text Books:

1. Ivan Bayross, Web Enable Commercial Application Development Using HTML, DHTML, Java script, PERL and CGI, BPB Publications, 2006.

2. Kathleen Kalata, Internet Programming with VBScript and JavaScript, Thomson learning, 2001.

3. J.Jaworski, Mastering Java script, BPB Publications, 1999.

Reference Books:

1. Powell, Thomas; Schneider, Fritz, JavaScript: The Complete Reference, TMH, 2nd edition2004.

2. T. A. Powell, Complete Reference HTML , (Third Edition),TMH, 2002

Web Sources:

1. www. geeksforseeks.com
2. www.nptel.ac.in

21PMCS11 LINUX PROGRAMMING LAB 0 0 42

Course Objective

This course gives practical training in Linux programming to perform the various commands in shell script. It gives hands on training in File operations in C Programming.

1. Write a shell script to perform the file operations using Linux commands.
2. Write a shell script to perform the operations of basic Linux utilities.
3. Write a shell script to perform nCr calculation using recursion.
4. Write the shell script to find the grade of student's marks.
5. Write a Shell script to display the numbers between 1 and 9999 in words.
6. Write a Shell script for Palindrome Checking.
7. Write a shell script to find the biggest of three numbers using command line arguments.
8. Write a shell script to find the number of characters, words and lines for a given file without using "wc"command.
9. Write a C program for implementation of system calls: a) open b) read &close c)create &write d) fork &exec
10. Write a C program for the following commands: a) cp b)mv c)delete
11. Write a C program to convert starting lowercase letter of each word into uppercase in a file.
12. Write a C program to print the contents of the file in reverse order.

Total: 30 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Create basic application using Linux

CO-2: Evaluate various Linux commands

CO-3: Apply Operating system concepts using Linux

CO-4: Apply String manipulation using Linux.

CO-5: Understand basic Linux commands

Text Books:

1. Richard Petersen, “Linux: The Complete Reference”, Sixth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi, Edition2008.
2. Neil Matthew, Richard stones, Alan Cox, “Beginning Linux Programming”, Wrox Publication.

Reference Books:

1. NIIT ,“Operating System LINUX”, PHI, Eastern Economy Edition, 2006

Web Sources:

1. www.youtube.com/watch?v=wBp0Rb-ZJak
2. www.javatpoint.com/linux

SEMESTER-II

21CMCS21 ADVANCED DBMS 4 0 0 4

Course Objective

This course aims to give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture, the system catalog, query optimization, centralized DB concepts, Normalization, distributed databases and client server architecture, advanced database concepts.

UNIT-1COMPARISON BETWEEN DIFFERENT DATABASES 12

Significance of Databases, Database System Applications, Advantages and Disadvantages of different Database Management systems, Comparison between DBMS, RDBMS, Distributed and Centralized DB.

UNIT-II RDBMS 12

Relational Query Languages, The SQL Query Language, Querying Multiple Relations, Creating Relations in SQL, Destroying and Altering Relations, Adding and Deleting Tuples, Integrity Constraints (ICs), Primary and Candidate Keys in SQL, Foreign Keys, Referential Integrity in SQL, Enforcing Referential Integrity.

UNIT- III CATEGORIES OF SQL COMMANDS 12

Data Definition, Data Manipulation Statements: SELECT - The Basic Form Subqueries, Functions, GROUP BY Feature, Updating the Database, Data Definition Facilities, Views, Embedded SQL *, Declaring Variables and Exceptions, Embedding SQL Statements, Transaction Processing, Consistency and Isolation, Atomicity and Durability, Dynamic SQL.

UNIT-IV NORMALIZATION 12

Functional Dependency, Anomalies in a Database, The normalization process: Conversion to first normal form, Conversion to second normal form, Conversion to third normal form, The boyce-code normal form(BCNF), Fourth Normal form and fifth normal form, normalization and database design, Denormalization

UNIT-V QUERY OPTIMIZATION 12

Algorithm for Executing Query Operations: External sorting, Select operation, Join operation, PROJECT and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization, Converting Query Tree to Query Evaluation Plan, multiquery optimization and application, Efficient and extensible

algorithms for multi-query optimization, execution strategies for SQL sub queries, Query Processing for SQL Updates.

Total : 60 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Evaluate hierarchy of DBMS.

CO-2: Analyze different types of SQL statement.

CO-3: Apply normalization in the database & understand the internal data structure.

CO-4: Understand the transaction system & could extract data efficiently.

CO-5: Understand the notion of transaction and its ACID properties

Text Books:

1. Date C. J, "An Introduction to Database Systems", Addison Wesley Longman, 8th Edition, 2003.
2. Catell, R.G.G., Barry, D.K., Berler, M., et al, "The Object Data Standard: ODMG 3.0", Morgan Kaufmann,2000.
3. Silberschatz A., Korth H., and Sudarshan S, "Database System Concepts", McGraw-Hill, 6th Edition, 2010.

Reference Books:

1. Charles F. Goldfarb, Paul Prescod, "The XML Handbook, Prentice Hall", 5th Edition, 2004.
2. Thomas M. Connolly, Carolyn Begg, "Database Systems: Practical approach to Design, Implementation and Management", Pearson Education Limited, 6th edition,2012.

Web Sources:

1. www.oracle-tutorial.com
2. www.studytonight.com

21CMCS22 ASP.NET PROGRAMMING 4 0 0 4

Course Objective

This course introduces the concepts and gain knowledge about the ASP.Net and helps the students to develop Dot Net based application using ADO.NET

UNIT-I INTRODUCTION TO .NET AND ASP.NET 12

The DOS Paradigm - The GUI Paradigm - The .Net Paradigm - .Net framework - Types, Objects and Namespaces - Setting up ASP.Net and IIS. Overview of dynamic web page-introduction & features of ASP.NET understanding ASP.NET controls-applications-web servers, installation of IIS.

UNIT-II ASP.NET CONTROLS 12

ASP.NET Controls: Web form, web forms Controls - server-controls-client controls-adding controls to web Form buttons-text box-labels-checkbox-radio buttons-list box. Adding controls a runtime Running a web application- creating a multiform web project

UNIT IIIASP.NET WEB PROGRAMMING 12

Form validation: client side and server side validation- Validation controls: required field comparison range- Calendar control- Ad rotator control- Internet Explorer control.How to manage state- how to use view state, session state and application state. How to use cookies. XML In .NET: XML Basics- Attributes- Fundamentals of XML Classes: Document- Text Writer- Text Reader- XML Validations- XML In ADO.NET,-Data Document

UNIT IVWEBSERVICES 12

Web Services: Introduction- State Management- View State- Session State- Application State- Service Description Language- Building & Consuming A Web Service. Web Application Development- Caching- Threading Concepts- Creating Threads In .NETManaging Threads- Thread Synchronization- Features Of .NET- Role Based Security & Code - Access Security- Permissions

UNIT V ADO.NET 12

ADO.NET: Overview of ADO.NET- from ADO to ADO.NET- ADO.NET Architecture-Accessing data using data adapters and datasets- using command and data Reader- binding data to data bind controls- displaying data in data grid.

Total: 60 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Create web application with ASP.Net Controls.

CO-2: Evaluate various web service architectures and their standards.

CO-3: Apply validation controls in developing online client page design for reservation, banking.

CO-4: Understand about DOS, GUI environment for developing good quality software project

CO-5: Understand basic building blocks of ASP.net environment

Text Books:

1. Mathew Macdonald - The Complete Reference ASP.NET - Tata McGraw Hill Publishing Pvt Ltd, 2005
2. Professional ASP.NET - Wrox publication PVT Ltd, 2007
3. Greg Buczek , ASP.NET Developer's Guide ,Tata McGraw Hill Edition, 2009
4. Michael Otey and DenielleOtey, "ADO.NET Complete Reference", Tata Macraw Hill Publication, 4th Edition,2007.
5. Math J. Croush , "ASP.net & VB.net web programming" (Pearson Education) ISBN-10: 0201734400, 2005

Reference Books:

1. Introduction to .NET framework - Wrox publication.
2. ASP.NET Unleashed - BPB Publication.Alex , "Professional ASP.NET 1.1", Wrox Publications, 2nd Edition, 2004.
3. ASP.NET Projects – Building 10 Enterprise Projects – Eric A. Smith

Web Sources:

1. www.tutorialsteacher.com/core
2. www.pragimtech.com/courses/asp-net-core-mvc-tutorial-for-beginners/

21CMSC23 PATTERN RECOGNITION 4 0 0 4

Course Objective

The students can learn about supervised and unsupervised pattern classifiers and familiarize about different feature extraction techniques. The learning also explores the role of Hidden Marko model and SVM in pattern recognition and to understand the application of Fuzzy logic and genetic algorithms for pattern classifier.

UNIT I PATTERN CLASSIFIER 12

Overview of Pattern recognition – Discriminate functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 12

Clustering for unsupervised learning and classification–Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 12

Principal Component Analysis (PCA) – Fisher Linear discriminate analysis – Expectation – maximization (EM) – Gaussian mixture models. Feature selection through functional approximation – Elements of formal grammars, Syntactic description – Stochastic grammars – Structural Representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 12

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V NEURAL PATTERN RECOGNITION 12

Neural Networks fundamentals, Learning in neural networks, Artificial Neural Networks model, activation functions, weights, Neural Network based Pattern Associators, Introduction Feed forward Network Architecture, Training in Feed forward Networks, GDR, Derivation of Delta Rule, Back propagation Algorithm, Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms

TOTAL: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate the feature extraction and elements of Pattern Recognition

CO-2: Analysis function, model and problems in Pattern Recognition

CO-3: Apply fuzzy logic and Pattern Classifiers using Genetic Algorithms

CO-4: Understand the fundamentals of Pattern Recognition techniques.

CO-5: Understand the Syntactic Pattern Recognition techniques.

Text Books:

1. M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.

2. Menahem Friedman , Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000.

Reference Books:

1. Andrew Webb, "Stastical Pattern Recognition", Arnold publishers, London,1999

2. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.

4. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001

5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press. 2009.

Web Sources:

1. www.mygreatlearning.com/blog/pattern-recognition-machine-learning/

2. minigranth.in/pattern-recognition-tutorial/introduction-pattern-recognition

21PMCS21 ADVANCED DBMS LAB 0 0 42

Course Objective

The student learns to work in DDL, DML, TCL and DCL, Joins. The student will be able to create cursors, manage users.

1. Learning basic DDL, DML, DCL and TCLcommands
2. Working with dualtable.
3. Use of Joins and Subqueries.
4. Views, sequences andindexes.
5. Managing users, privileges androles.
6. PL/SQL-Data types, controlstructures.
7. Creating procedures with PL/SQL.
8. Error handling in PL/SQL.
9. Cursor Management in PL/SQL.
10. Writing Programs on Packages &triggers.
11. Embedding PL/SQL in high levellanguage.
12. Implementation of Triggers & Assertions for BankDatabase.

Total: 30 Hours

Course Outcomes:

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

CO-1: Create an application to check user defined exception using PL/SQL.

CO-2: Evaluate the functionalities of trigger and cursor.

CO-3: Analyze different types of built-in function in PL/SQL.

CO-4: Apply DDL, DML and DCL statement using SQL.

CO-5: Apply various types of joins in tables.

Text Books:

1. A. Silberschatz, H. F. Korth, S.Sudharsan, Database System Concepts,Sixth Edition, Tata McGraw Hill, 2011.
2. Ivan Bayross, SQL,PL/SQL, The programming language of Oracle, Second Revised Edition, BPB Publication, 2015

Reference Books:

1. R.Elmasri, S.B.Navathe, Fundamentals of Database systems, Fifth Edition,Pearson Education,2008.
2. C. J. Date, Introduction to Database Systems, Fifth Edition, Pearson Education, 2005.

Web Sources:

1. www.guru99.com/dbms-tutorial.html
2. www.oracletutorial.com

21PMCS22 ASP .NET PROGRAMMING LAB 0 0 4 2

Course Objective: This course gives practical training in Network programming using Active Server Pages ActiveX Data Object Dot Net with various applications.

1. Demonstration of Login Processing using ASP.NET
2. Demonstration of Validation controls in ASP.NET
3. Deployment of Calendar Control inASP.NET
4. Traversing and selecting a Product Name displayed in dropdown list, through coding in The Form Load Event inASP.NET
5. Creation of Web Application in ASP.NET for Conditions-based book issue in a Library
6. Construction of Banking Application with Implementation of Web-user controls in ASP.NET.
7. Create web Application for Course Registration in ASP.NET with ADO.NET
8. Create web Application for Airline reservation in ASP.NET with ADO.NET
9. Create web Application for Shopping Cartin ASP.NET with ADO.NET
10. Create web Application for Job portal in ASP.NET with ADO.NET
11. Create web Application for On-Line Telephone Billing System in ASP.NET with ADO.NET
12. Create web Application for Hospital Management System inASP.NET with ADO.NET

Total: 30 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Create login processing application using ASP .NET.

CO-2: Create Banking application and library application using ASP .NET.

CO-3: Analyze validation controls in ASP .NET

CO-4: Analyze Calendar Control in ASP. NET

CO-5: Apply Data Grid control in ADO .NET.

Text Books:

1. Joe Duffy, Professional .NET Framework 2.0, Wrox Publications, 2006 Edition.
2. Steven Holzner, Visual Basic.NET Programming – Black Book, Paraglyph Press and DreamTech Press, 2005 Edition.

Reference Books:

1. Alex, Professional ASP.NET 1.1, Wrox Publications, 2nd Edition, 2004.
2. Michael Otey and Denielle Otey, ADO.NET Complete Reference, Tata McGraw Hill Publication, 4th Edition, 2007.

Web Sources:

1. http://www. projects.students3k.com/projects/mini-projects-in-asp-net.
2. www.vbtutor.net/index.php/visual-basic-net-tutorials/

SEMESTER-III

21CMCS31 NATURAL LANGUAGE PROCESSING 4 0 0 4

Course Objective

The Course provides the models, methods, and algorithms of statistical Natural Language Processing (NLP) for common NLP tasks, such as speech recognition, machine translation ,spam filtering, text classification and spell checking.

Course Outcome

UNIT I OVERVIEW AND LANGUAGE MODELLING 12

Overview - Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval - Language Modeling: Various Grammar - based Language Models - Statistical Language Model.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS 12

Word Level Analysis - Regular Expressions - Finite-State Automata - Morphological Parsing - Spelling Error Detection and correction - Words and Word classes - Part-of Speech Tagging. Syntactic Analysis – Context - free Grammar - Constituency - Parsing - Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING 12

Semantic Analysis - Meaning Representation - Lexical Semantics – Ambiguity - Word Sense Disambiguation - Discourse Processing – Cohesion - Reference Resolution – Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION 12

Natural Language Generation - Architecture of NLG Systems - Generation Tasks and Representations - Application of NLG. Machine Translation - Problems in Machine Translation - Characteristics of Indian Languages - Machine Translation Approaches - Translation involving Indian Languages.

UNIT V INFORMATION RETRIEVAL AND LEXICAL RESOURCES 12

Information Retrieval - Design features of Information Retrieval Systems – Classical - Nonclassical - Alternative Models of Information Retrieval – valuation Lexical Resources: World Net - Frame Net - Stemmers - POS Tagger - Research Corpora.

Total: 60 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Analyze experimental results and write reports for each course project to develop scientific writing skills.

CO-2: Apply core computer science concepts and algorithms, such as dynamic programming.

CO-3: Apply the methods to new NLP problems and will be able to apply the methods to problems outside NLP.

CO-4: Understand the linguistic phenomena and to explore the linguistic features relevant to each NLP task.

CO-5: Understand natural language processing and to learn how to apply basic algorithms in this field.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin /Cummings publishing company, 1995.

Web Sources:

1. www.towardsdatascience.com/a-practitioners-guide-to-natural-language-processing-part-i-processing-understanding-text-9f4abfd13e72
2. www.javatpoint.com/nlp

21CMCS32 DEEP LEARNING 3 0 0 3

Course Objectives

To understand the major technology trends driving Deep Learning and apply fully connected deep neural networks. This course is used to analyse the key parameters and hyper parameters in a neural network's architecture.

UNIT I PROBABILITY AND INFORMATION THEORY 9

Random Variables- Probability Distributions- Marginal Probability- Conditional Probability- Expectation- Variance and Covariance- Bayes' Rule-Information Theory - Numerical Computation- Overflow and Underflow- Gradient-BasedOptimization- Constrained Optimization- Linear Least Squares.

UNIT II MACHINE LEARNING BASICS 9

Machine Learning Basics and under fitting, Hyper parameters and Validation Sets Estimators-Bayesian Statistics- Supervised and Unsupervised Learning-Stochastic Gradient Descent- Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR- Gradient-Based Learning- Hidden Units-Architecture Design- Back-Propagation and other Differentiation Algorithms.

UNIT III REGULARIZATION FOR DEEP LEARNING 9

Regularization for Deep Learning: Parameter Norm Penalties- Norm Penalties as Constrained Optimization- Regularization and Under-Constrained Problems- Dataset Augmentation- Noise Robustness- Semi-Supervised Learning- Multi-Task Learning-Optimization for Training Deep Models: Pure Optimization- Challenges in Neural Network Optimization- Basic Algorithms- Algorithms with Adaptive Learning Rates-Optimization Strategies and Meta-Algorithms.

UNIT IV CONVOLUTIONAL NETWORKS 9

Convolutional Networks: The Convolution Operation, Pooling- Convolution- Basic Convolution Functions -Structured Outputs, Data Types -Efficient Convolution Algorithms- Random or Unsupervised Features -Basis for Convolutional Networks.

UNIT V SEQUENCE MODELLING 9

Sequence Modeling: Recurrent and Recursive Nets- Unfolding Computational Graphs-

Recurrent Neural Networks- Bidirectional RNNs-Deep Recurrent Networks - Recursive Neural Networks- Echo State Networks- LSTM –Gated RNNs- Optimization for Long-Term Dependencies.

Total : 45 hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Analyze mathematical foundation of neural network.

CO-2: Apply Efficient Convolution Algorithms.

CO-3: Understand the Concept of Convolutional Networks.

CO-4: Understand about Information theory.

CO-5: Understand Supervised and Unsupervised Learning.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

Reference Books:

1. Nikhil Buduma, O'Reilly, Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Shroff Publishers, 2019.
2. Douwe Osinga, O'Reilly,Deep learning Cook Book, Practical recipes to get started Quickly, Shroff Publishers, 2019.

Web Sources:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf

21CMCS32 MOBILEAPPLICATIONDEVELOPMENT 3 0 4 4

Course Objective

Understand system requirements for mobile applications, Generate suitable design using specific mobile development frameworks, Generate mobile application design, Implement the design using specific mobile development frameworks, Deploy the mobile applications in marketplace for distribution.

UNIT I INTRODUCTION 9

Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Frameworks and Tools – Mobile devices Profiles.

UNIT II USER INTERFACE 9

Generic UI Development – VUIs and Mobile Applications – Text to Speech techniques – Designing the right UI – Multimodal and Multichannel UI – Gesture based UIs – Screen Elements and Layouts – Voice XML – Java API.

UNIT III APPLICATION DESIGN 9

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Dynamic Linking – Plug ins and rules of thumb for using DLLs – Concurrency and Resource Management – Look and feel.

UNIT IV APPLICATION DEVELOPMENT 9

Intents and Services – Storing and Retrieving data –Communication via the Web – Communication Methods(JSON)- Notification and Alarms – Graphics and Multimedia – Video Streaming-Telephony – Location based services – Map Integration -Packaging and Deployment – Designing APP across multiple devices and operating systems(Phonegap)- Security and Hacking.

UNIT V TOOLS 9

Google Android Platform – Eclipse Simulator – Android Application Architecture –Event based programming – Apple iPhone Platform – UI tool kit interfaces – Event handling and Graphics services – Layer Animation.

Practicum:

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.
12. Create an application to handle images and videos according to size.

Total: 60 Hours

Course Outcome

At the End of this course, the Student will be able to:

CO-1: Create design using JSON.
CO-2: Analyze the requirements for mobile applications.
CO-3: Understand the Develop design for mobile applications for specific requirements
CO-4: Understand the basic Frameworks and tools used in mobile application.
CO- 5: Understand the capabilities and limitations of mobile devices.

Text Books:

1. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming Android", O"Reilly,2011.
2. Reto Meier, Wrox Wiley, "Professional Android 2 Application Development",2010.
3. Alasdair Allan, "iPhone Programming", O"Reilly,2010.

Reference Books:

1. Wei-Meng Lee, “Beginning iPhone SDK Programming with Objective-C”, Wrox Wiley,2010.
2. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and interactions”, Wiley,2009.

Web Sources:

1. www.learnvern.com/course/android-tutorial
2. www.udemy.com/course/learn-android-application-development-y/

21PMCS32 MINI PROJECT 0 0 4 2

Course Objectives : The objective of the mini project is to help the student develop the ability to apply theoretical and practical tools / techniques to solve real life problems related to industry academic institutions.

Students are to take up sample project development activities with the guidelines given below:

Preparing a project - brief proposal including:

- Problem Identification
- Developing a model for solving the problem
- A statement of system / process specifications proposed to be developed (Data Flow Diagram)
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
- Time line activities

A report highlighting the design finalization [based on functional requirements & standards (if any)]

A presentation including the following:

- Implementation phase (Hardware / Software / both)
- Testing & Validation of the developed system
- Learning in the project

Consolidated report preparation.

Course Outcome:

At the End of this Course, the Student will be able to:

CO-1: Create new project with Report:

CO-2: Evaluate project scope and Objectives.

CO-3: Analyze Software, Hardware and tools needed for the project.

CO-4: Apply technical knowledge to solve project problem.

CO-5: Understand the implementation of Project

Total: 60 Hours

SEMESTER-IV

21CMCS41 INTERNET OF THINGS 4 0 0 4

Course Objective: Student will understand the evolution of internet technology and need for IoT. The course will cover the basics of communications concepts, characteristics of sensors, protocols and the need of security in the Internet of Things.

UNIT I: EVOLUTION OF IOT 12

Review of computer communication concepts- OSI layers – components - packet communication – Networks - TCP-IP – subnetting - IPV4 addressing and challenges. IPV6 addressing - IoT architecture reference layer.

UNIT II: INTRODUCTION TO IOT COMPONENTS 12

Characteristics IoT sensor nodes - Edge computer - cloud and peripheral cloud - single board computers- open source hardware's - Examples of IoT infrastructure.

UNIT III:IOT PROTOCOLS AND SOFTWARES 12

MQTT – UDP - MQTT brokers - publish subscribe modes – HTTP - COAP - XMPP and gateway protocols – IoT Communication Pattern – IoT protocol Architecture - Selection of Wireless technologies.

UNIT IV: IOT SECURITY 12

Need for encryption - standard encryption protocol - light weight cryptography - Quadruple Trust Model for IoT – Threat Analysis and model for IoT-A, Cloud security

UNIT V: ARDUINO PROGRAMMING 12

Arduino UNO-Setup-IDE Overview-Sktech structure- Data types-Operators-Control statement-Loops-Arrays-String- Math Library-Random Number-Interrupts-Example Program.

. **Total: 60 Hours**

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Analyze the concepts the network concepts like TCP-IP, subnetting, IPV4.

CO-2: Analyze the characteristics sensors, edge computer cloud and its peripherals.

CO-3: Apply selection of wireless technologies.

CO-4: Understand the architecture of IoT reference layer.

CO-5: Understand the protocols like MQTT, UDP, etc.,

Text Books:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016 2.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.

Reference Books:

1. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.
2. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2015

Web Sources:

1. data-flair.training/blogs/iot-tutorial/
2. mindmajix.com/iot-tutorial

21RMCS41 PROJECT WORK 0 0 20 10

OBJECTIVES

The objective of the project is to help the student develop the ability to apply theoretical and practical tools / techniques to solve real life problems related to industry academic institutions and research laboratories. After the completion of this project work the student should be able to describe the Systems Development Life Cycle (SDLC) in their carried out project:

- Evaluate systems requirements.
- Evaluate a problem definition.
- Collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis technical feasibility time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries/ decision trees/ decision table.
- Create and evaluate graphical tools as systems flow charts entity-relationship (ER) diagrams and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.

♣ Plan the systems design phase of the SDLC.

- Distinguish between logical and physical design requirements.

♣ Design and evaluate system outputs.

- Design and evaluate systems inputs.
- Design and evaluate validity checks for input data.
- Design and evaluate user interfaces for input.
- Estimate storage requirements.
- Decide and describe various data structures.
- Perform coding for the project.
- Documentation requirements and prepare documentation.
- Perform various testing techniques/strategies.
- Be able to generate various reports in project.
- Able to deploy the project on machine/Lab/Real time environment
- Brief the maintenance procedures.
- To decide the future scope and further enhancement of the system.
- Plan for appendices (if any) to be placed in support with the project report documentation.

TYPE OF PROJECT

The majority of the students are expected to work on a real-life project preferably in some industry/ Research and Development Laboratories / Educational Institution / Software Company. Students are encouraged to work in the various areas of computer applications .However it is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Supervisor and if approved the student can commence working on it.

Course Outcome:

At the End of this Course, the Student will be able to:

CO-1: Create new project with Report:

CO-2: Evaluate project scope and Objectives.

CO-3: Analyze Software, Hardware and tools needed for the project.

CO-4: Apply technical knowledge to solve project problem.

CO-5: Understand the implementation of Project

Total: 150 Hours

Discipline Specific Electives

THEORY OF AUTOMATA 4 0 0 4

Course Objective

The goal of this course is to provide an understanding of basic concepts in the theory of computation. Students will learn about a variety of issues in the mathematical development of computer science theory, particularly finite representations for languages and machines.

UNIT I AUTOMATA THEORY 12

Introduction – Structural representation – Automata and Complexity –Alphabets – Strings – Languages – Problems. Finite Automata: Introduction– Deterministic Finite Automata – Non-Deterministic Finite Automata - Application: Text Search – Finite Automata with Epsilon-Transitions.

UNIT II REGULAR EXPRESSIONS 12

Regular Expressions – Finite Automata and Regular Expressions – Applications of Regular Expressions - Algebraic Laws for Regular Expressions – Proving Languages not to be Regular – Decision Properties of Regular Languages – Equivalence and Minimization of Automata – Moore and Mealy Machines.

UNIT III CONTEXT-FREEGRAMMARS 12

Definition – Derivations using a Grammar – Leftmost and Rightmost Derivations – The Language of a Grammar – Sentential Forms - Parse Trees - Pushdown Automata: Definition –Languages of a PDA – Equivalence of PDA's and CFG's - Deterministic Pushdown Automata.

UNIT IV TURINGMACHINE 12

Introduction – Notation - Description – Transition Diagram – Languages – Turing Machines and Halting – Programming Techniques for Turing Machines – Multitape Turing Machine – Restricted Turing Machines – Turing Machines and Computers.

UNIT V INTRACTABLEPROBLEMS 12

The Classes P and NP - The NP Complete Problem – Complements of Languages in NP – Problems solvable in polynomial space.

Total : 60 Hours

Course Outcome

At the End of this course, the student will be able to:

CO - 1: Analyze problem-solving situations in related areas of theory in computer science.

CO - 2: Apply Regular Expression and its concepts.

CO - 3:. Apply context-free languages, push-down automata.

CO - 4: Apply the concept of CFG

CO – 5: Understand the concept of heoretical foundations of computer science.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2001.

Reference Books:

1. S.P.Eugene Xavier, "Theory of Automata, Formal Languages and Computation", New Age International,2004.
2. A.M.Natarajan, A.Tamilarasi, P.Balasubramani, "Theory of Computation, New Age International",2003.
3. E.V.Krishnamurthy, "Introductory Theory of Computer Science", East-West Press Pvt. Ltd,1983.
4. Bernard M. Moret, " The Theory of Computation", Pearson Education,1998.

Web Sources:

1. www.nptel.ac.in.
2. www.ocw.mit.edu/courses/mathematics/18-404j-theory-of-computation- fall-2006.
3. www.coursera.org/courses.

COMPUTATIONAL INTELLIGENCE 4 0 0 4

Course Objective:

The course makes students familiar with basic principles of various computational methods of data processing that can commonly be called computational intelligence.To help the students to design and build CI algorithms and approaches to real-life problems, analyses and improve these algorithms and approaches, discuss decisions made during the development processes

UNIT I INTRODUCTION 12

Artificial Intelligence – a brief review – Pitfalls of traditional AI – Why Computational Intelligence? – Computational intelligence concept - Importance of tolerance of imprecision and uncertainty - Constituent techniques – Overview of Artificial Neural Networks, Fuzzy Logic, Evolutionary Computation

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 12

Proposition Logic – First Order Predicate Logic – Unification – Forward Chaining - Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information – Prolog Programming.

UNIT III UNCERTAINTY 12

Non monotonic reasoning - Fuzzy Logic - Fuzzy rules - fuzzy inference - Temporal Logic- Temporal Reasoning - Neural Networks - Neuro-fuzzy Inference.

UNIT IV LEARNING 12

Probability basics – Bayes Rule and its Applications – Bayesian Networks – Exact and Approximate Inference in Bayesian Networks – Hidden Markov Models – Forms of Learning – Supervised Learning – Learning Decision Trees – Regression and Classification with Linear Models – Artificial Neural Networks – Nonparametric Models – Support Vector Machines – Statistical Learning – Learning with Complete Data – Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

UNIT V INTELLIGENCE AND APPLICATIONS 12

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AIl applications – Language Models – Information Retrieval – Information Extraction – Machine Translation – Machine Learning – Symbol-Based – Machine Learning: Connectionist – Machine Learning.

Total : 60 hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate Fuzzy Logic applications

CO-2: Analyze Problem-solving through various searching techniques.

CO-3: Apply Computational Intelligence techniques for information retrieval

CO-4: Apply the Intelligent techniques for problem solving

CO-5: Understand fundamental concepts in Computational intelligence.

Text Books:

1. Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.
2. Konar A., "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005.
3. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education / Prentice Hall of India, 2010.

Reference Books:

1. Elaine Rich and Kevin Knight, Artificial Intelligence, Third Edition, Tata McGraw-Hill, 2010.
2. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
3. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.
4. Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Harcourt Asia Pvt. Ltd., 2000.

Web Sources:

1. http://www.softcomputing.net/tutorial.html
2. www.tutorialteacher.net

BLOCKCHAINTECHNOLOGY 4 0 0 4

Course Objective:

This course covers the technical aspects of public distributed ledgers, block chain systems, crypto currencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

UNIT-I BLOCKCHAIN BASICS 12

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof positions.

UNIT-II INTRODUCTION TO BLOCK CHAIN 12

Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

UNIT-III DISTRIBUTED CONSENSUS AND CRYPTO CURRENCY 12

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.

UNIT-IV CRYPTO CURRENCY REGULATION 12

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.

UNITV CASE STUDY ON BLOCK CHAIN 12

Case study on Naive Block chain construction, Memory Hard algorithm – Hash cash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Block chain, Mining puzzles

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate a method for solving a problem case study with different perspective

CO-2: Analyze limitations and proofs are another essential part of block chain technologies, which are learned for betterment of creating block chain.

CO-3: Apply latest crypto currency aspects leads students to understand some of basic concepts of Black Market and Global Economy

CO-4: Understand block chain technologies basics

CO-5: Describing the history behind the block chain and learning about Vulnerability, Attacks and Side chain gives an additional support for creating a secured block chain.

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19,2016).

Reference Books:

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Crypto currency and Applications', Oxford University Press,2019.
2. Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block chainTechnology and Block chain Programming', Create Space Independent Publishing Platform,2017.

Web Sources:

1. https://www.blockchainexpert.uk/book/blockchain-book.pdf
2. https://users.cs.fiu.edu/~prabakar/cen5079/Common/textbooks/Mastering_Blockchain_2nd Edition. pdf
3. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/study-blockchain-impact-moving-beyond-hype_0.pdf

CLOUDCOMPUTING 4 0 0 4

Course Objective: This course introduces the fundamental concepts of cloud computing, itsservicesandTools.Analyzethecomparativeadvantagesanddisadvantagesofcloud computing.

UNIT I CLOUD COMPUTING 12

History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNITII WEB-BASED APPLICATION 12

Pros and Cons of Cloud Service Development – Types of Cloud Service Development– Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud ServicesDevelopmentServicesandTools–AmazonEc2– GoogleAppEngine-IBMClouds.

UNIT III CENTRALIZING E MAIL COMMUNICATIONS 12

Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists-CloudComputingfortheCommunityCollaboratingonGroupProjectsandEventsfortheCorporation

UNIT IV COLLABORATING ON CALENDARS SCHEDULES AND TASK MANAGEMENT 12

Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases– Storing and Sharing Files.

UNIT V COLLABORATING VIA WEB-BASEDCOMMUNICATIONTOOLS 12

Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Create applications by utilizing cloud platforms.

CO-2: Evaluate cloud computing driven commercial systems such as Google Apps and Microsoft Azure.

CO-3: Analyze own organization's needs for capacity building and training in cloud related IT areas.

CO-4: Apply appropriate technologies and approaches for the related issues to cloud computing.

CO-5: Understanding the key dimensions of the challenges of cloud computing.

Text Books:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August2008.
2. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July2008.

Reference Books:

1. velete, Antony. T, Cloud computing a practical approach 2010, TMH, 4th Edition, 2007.
2. Jennings, Roger, Cloud computing with Windows Azure platform, PHI,2009.

Web Sources:

1. www.coursera.com
2. www.javatpoint.com

SOFTWARE QUALITYASSURANCE 4 0 0 4

Course Objective:

This course introduces the basic concepts of Software Quality Control and Assurance with different quality measures and standards for real time software projects as case studies.

UNIT I INTRODUCTION 12

Quality and the quality system - standards and procedures technical activities. Software tasks - management responsibility - quality system - contract review - design control - document control - purchasing product identification and traceability.

UNIT II PROCESS CONTROL 12

Checking - Identification of Testing Tools - Control of Nonconforming Product - Corrective Action- Verification: Verification techniques – Inspections, reviews, walk-throughs – Case studies.

UNIT III QUALITY AUDITS 12

Handling,Storage,PackingAndDelivery-QualityRecords-InternalQualityAudits-Training-Servicing- Statistical Techniques-Views On Quality – Cost Of Quality - Quality Models – Quality Frameworks – Verification And Validation – Defect Taxonomy – Defect Management – Statistics And Measurements – IEEE Standards – Quality Assurance And Control Processes.

UNIT IV QUALITY ASSURANCE TECHNOLOGIES 12

QAAndNewTechnologies-QAandHuman-Computerinterface-ProcessModeling-Standards And Procedures- Coverages: Block, Conditions, Multiple Conditions, MC/DC, Path – Data Flow Graph–DefinitionAndUseCoverages–C-Use,P-Use,Defclear,Def-Use–FiniteStateMachines– Transition Coverage.

UNIT V INDIAN STANDARDS 12

ISO – ISO Standards-Development Process-ISO Certification – ISO Consulting Service And Consultants-E-Business- 9001 - Elements of ISO 9001 - Improving Quality System - Case Study.

Total : 60 hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Analyze Software Quality Management – Quality Factors, components and Plans.

CO-2: Apply Software Quality Metrics and Quality Assurance Standards.

CO-3: Apply various tools for Testing.

CO-4: Apply different verification techniques for software development.

CO-5: Understand Software Quality Audit and illustrate Quality frameworks concepts.

Text Books:

1. Claude Y. Laporte, Alain April , "Software Quality Assurance", Wiley-IEEE Computer Society Press,2018.
2. Watts S. Humphrey, "Managing the software process", Addison Wesley,1999.

Reference Books:

3. Tsum S.Chow, "Software Quality Assurance a Practical Approach", IEEE Computer Society press,1985.
4. RogerS.Pressman,"SoftwareEngineering-APractitioner'sapproach", McGrawHill,8th Edition, 2019.

Web Sources:

1. http://www.tutorialsspace.com/Software-Engineering/
2. http://www.nptel.com

CRYPTOGRAPHY AND ITS APPLICATIONS 4 0 0 4

Course Objective: To understand the fundamentals of Cryptography, acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. To understand the various key distribution and management schemes and to explore how to deploy encryption techniques to secure data in transit across data networks.

UNIT I INTRODUCTION &NUMBER THEORY 12

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Finite Fields and Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm - Finite fields - Polynomial Arithmetic – Prime numbers - Fermat's and Euler's theorem -Testing for primarily – The Chinese remainder theorem-Discrete algorithms.

UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 12

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange – Elliptic curve arithmetic-Elliptic curve cryptography.

UNITIII HASH FUNCTIONS AND DIGITAL SIGNATURES 12

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature &authentication Protocols.

UNITIV SECURITY PRACTICE &SYSTEM SECURITY 12

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems.

UNIT V CASE STUDY ON E-MAIL, IP &WEBSECURITY 12

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy - authentication of the source - Message Integrity - Non-

repudiation - Pretty Good Privacy - S/MIME. IPSecurity: Overview of IPSec - IP and IPv6 - Authentication Header - Encapsulation Security Payload (ESP) - Web Security: SSL/TLS Basic Protocol-computing the keys - Encoding- Secure Electronic Transaction (SET).

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Analyze computer and network security threats, classify the threats and develop a Security model to prevent, detect and recover from theattacks.

CO-2: Apply Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verificationalgorithms.

CO-3: Apply Knowledge and understanding of Basics of number theory, Key management, Public key cryptosystems, Message authentication, Hash functions and algorithms.

CO-4: Understand network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).

CO-5: Understand with advanced security issues and technologies.

Text Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India,2002.

Reference Books:

1. Bernard Menezes,"Network Security and Cryptography", Cengage Learning,India Edition,2010.
2. Behrouz A.Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Second Edition,2010.

Web Sources:

3. www.javatpoint.com
4. www.geeksforgeek.com

BIG DATA ANALYTICS 4 0 0 4

Course Objective: To explore, design, and implement basic concepts of big data & analytics methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and its application to the business needs.

UNIT I INTRODUCTION TO BIG DATA 12

Introduction to Big Data Platform – Challenges of Conventional Systems - Nature of Data- Evolution Of Analytic Scalability - Intelligent data analysis- Analytic Processes and Tools -Analysis vs Reporting - Modern Data Analytic Tools

UNIT II MINING DATA STREAMS 12

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing -Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Real Time Analytics Platform (RTAP) Applications

UNIT III ADVANCED ANALYTICS 12

Analyzing, Visualization and Exploring the Data, Statistics for Model Building and Evaluation, Advanced Analytics - K-means clustering, Association rules-Speedup, Linear Regression, Logistic Regression, Naïve Bayes, Decision Trees, Time Series Analysis, Text Analysis.

UNIT IV HADOOP 12

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop - Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming

UNIT V FRAMEWORKS 12

Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

TOTAL: 60 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Evaluate Big Data real time analytics platform applications.

CO-2: Analyze big data platform and learn intelligent data analysis and compare old and modern data analytic tool.

CO-3: Apply advanced analytics techniques to gain knowledge of latest techniques.

CO-4: Understand the data streams concepts and stream computing.

CO-5: Understand the fundamental concepts of big data platform and know about the basic concepts of nature and evolution of big data.

Text Book:

1. Prajapati, Big Data Analytics with R and Hadoop, 2014

Reference Book:

1. Stephan Kudyba, Big Data, Mining, and Analytics: Components of Strategic Decision Making,Auerbach Publications, March 12, 2014.
2. Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications, 2013

Web Sources:

1. www.intellipaat.com/blog/big-data-tutorial-for-beginners/
2. www.simplilearn.com/tutorials/data-analytics-tutorial

PARALLEL AND DISTRIBUTEDCOMPUTINGSYSTEM 4 0 0 4

Course Objective: To learn parallel and distributed algorithm development techniques for shared memory and message passing models, to study the main classes of parallel algorithms, to study the complexity and correctness models for parallel algorithms.

UNIT I INTRODUCTION **12**

Basic Techniques - Parallel Computers for Increase Computation Speed - Parallel &Cluster Computing

UNIT IIPARALLEL PROGRAMS **12**

Message Passing Technique - Evaluating Parallel Programs and Debugging - Portioning And Divide And Conquer Strategies Examples

UNIT III PIPELININGTECHNIQUES **12**

Pipelining - Techniques Computing Platform - Pipeline Programs Examples.

UNIT IV SHARED MEMORY **12**

Synchronous Computations - Load Balancing - Distributed Termination Examples - Programming With Shared Memory - Shared Memory Multiprocessor Constructs For Specifying Parallel List - Sharing Data Parallel Programming Languages And Constructs - OpenMP.

UNITV DISTRIBUTED SHARED MEMORYSYSTEMS: **12**

Distributed Shared Memory Systems And Programming Achieving Constant Memory Distributed Shared Memory Programming Primitive - Algorithms – Sorting And Numerical Algorithms.

Total: 60 hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Evaluate concepts of Parallel computing systems.
CO-2: Analyze about Cluster Computing systems.

CO-3: Apply Message Passing Technique.

CO-4: Apply Parallel programs and debugging.

CO-5: Understand Pipelining Techniques and examples.

Text Books:

1. Barry Wilkinson, Michael Allen, “Parallel Programming”, Pearson Education, 2nd Edition.
2. Jaja, “Introduction to Parallel algorithms”, Pearson,1992.

Reference Book:

1. Calvin Lin, Larry Snyder, “Principles of Parallel Programming”, Addison-Wesley, 2008.

Web Sources:

1. www.coursere.org
2. www.nptel.ac.in

NEURAL NETWORK 4 0 0 4

Course Objectives:

Provide an understanding of the basic mathematical elements of the theory of fuzzy sets. Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories. Explain the concepts of neural networks, fuzzy logic, and geneticalgorithms.

UNIT I BASIC LEARNING ALGORITHMS 12

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback – Learning Process: Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering - Beamforming – Memory – Adaptation - Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES RADIAL BASIS FUNCTION NETWORKS

12

Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks Applications: XOR Problem – Image Classification. **SUPPORT VECTOR MACHINES*:*** Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector - insensitive Loss Function – Support Vector Machine for Pattern Recognition – XOR Problem - Machines for Nonlinear Regression

UNIT III COMMITTEE MACHINES AND NEURO DYNAMICS SYSTEMS 12

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A Priori and Post priori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model – EM Algorithm – Applications of EM Algorithm to HME

Model - Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neurodynamical Systems – The Cohen-GrossbergTheorem.

UNIT IV ATTRACTOR NEURAL NETWORKS 12

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos- Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs – Applications

UNIT V SELF ORGANISING MAPS AND PULSEDNEURONMODELS 12

Self-Organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications - Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with SpikingNeurons.

TOTAL: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate the Architecture of different neural networks.

CO-2: Analyze wide variety of learning algorithms.

CO-3: Apply supervised learning.

CO-4: Understand about unsupervised learning.

CO-5: Understanding limitations of various learning algorithms.

Text Books:

1. NunesDaSilvaI ,Artificial Neural Networks A Practical Course",SPRINGER,ISBN-9783319431611,January, 2017

Reference Books:

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi,2004.
2. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2ed., Addison Wesley Longman (Singapore) Private Limited, Delhi,2001.

Web Sources:

1. www.edureka.com
2. www.coursera.org

ADVANCED COMPILER DESIGN 4 0 0 4

Course Objective: This course gives an insight into introduction, parsing techniques of compiler, working with syntax, grammar and semantics of programming languages proving students with an analogy to help them understand how grammar works for programming languages.

UNITI INTRODUCTION 12

Introduction – Structure of a optimizing Compiler – Compiler writing tools – Basic constructs of High level programming languages – Data structures – Parameter transmission. Lexical Analysis – Role of Lexical analyzer – Finite Automata – Regular Expressions to Finite Automata – Minimizing number of states of Deterministic Finite Automaton –Implementation of Lexical analyzer in C.

UNIT II PARSING TECHNIQUES 12

Parsing Techniques – Context free Grammars – Derivations and Parse trees –Ambiguity – Capabilities of Context free grammar-Handling errors in Context free grammars-Parsers and Recognizers - Top down and Bottom up Parsing –Grammar analysis Algorithm- Handles – Shift Reduce parsing – Operator precedence parsing – Recursive Descent parsing – Predictive Parsing.

UNIT III AUTOMATICPARSINGTECHNIQUES12

Automatic Parsing Techniques – LR parser – Canonical Collection of LR(0) items – Construction of SLR parsing tables – LR(1) sets of items construction-LALR(1) – Construction of canonical LR parsing tables- Use of Bison or YACC.

UNIT IV INTERMEDIATE CODE 12

Syntax Directed Translation – Semantic action – Implementation of syntax directed translators – Intermediate code: Prefix notation, Quadruples, Triples, and Indirect triples –Methods of translation of assignment statements, Boolean expressions and Control statements.

UNIT V LOWERBOUNDALGORITHM 12

Symbol Tables and Code Generation: Representing information in a symbol table –Data structures for symbol table – Introduction to code optimization – Basic blocks –DAG representation – Error detection and Recovery – Semantic Processing- Code generation and

local code optimization.

Total: 60 Hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: To understand the introduction of compiler and phases of compiler.
CO-1: Evaluate concepts of lexical analyzer and Finite Automation.
CO-2: Analyze key concepts of context-free grammar.
CO-3: Apply different parsing techniques and construction of syntax tree.
CO-4: Understand advanced features of automatic parsing techniques specifically LR parser, SLR parser.
CO-5: Understand the concepts of construction of LR, SLR parsing table. to construct code generator.

Text Books:

1. V.Aho, Ravi Sheethi, "Compilers-Principles, Techniques and Tools", Pearson Education, 3rd Edition,2007.
2. David Galles, "Modern Compiler Design", Pearson Education Asia,2007.

Reference Books:

1. Steven S. Muchnick, "Advanced Compiler Design & Implementation", Morgan Kaufmann Publishers,2000.
2. C. N. Fisher and R. J. LeBlanc, " Crafting a Compiler with C", Pearson Education, 2000.

Web Sources:

1. www.nescoacademy.com
2. www.nptel.ac.in

MOBILE COMPUTING 4 0 0 4

Course Objective:

This course introduces the basic concepts of mobile computing, communication systems, mobile and wireless devices, GSM – Architecture – Routing Strategies –TCP.

UNIT I INTRODUCTION 12

Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmissions –Multiplexing – Spread Spectrum and Cellular Systems- Medium Access Control –Comparisons.

UNITII TELECOMMUNICATION SYSTEMS 12

GSM – Architecture – Sessions –Protocols – Hand Over and Security – UMTS and IMT – 2000– Satellite Systems - Types of Satellite System - Routing- Localization

UNIT III WIRELESS LAN 12

IEEE S02.11: System Architecture-Protocol Architecture, Physical Layer, 802.11b and 802.11a– Hiper LAN: WATM, BRAN, HYPERLAN2 – Bluetooth: User Scenarios, Architecture, Radio Layer, BasebandLayer,LinkManagerProtocol,L2CAP,Security,SDP– SecurityandLinkManagement.

UNIT IV MOBILE NETWORK LAYER 12

Mobile IP – Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies.

UNITV MOBILE TRANSPORT LAYER 12

Congestion Control – Implication of TCP Improvement – Mobility – Indirect – Snooping – Mobile – Transaction oriented TCP - TCP over wireless – Performance - Case study analysis: Smart Phone Enhanced Shopping, Advances on Sensors for HealthSystems.

TOTAL: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate about various wireless LAN techniques.

CO-2: Analyze radio signal propagation issues and their impact on communication system performance.

CO-3: Understand about various wireless systems and standards and their basic operation cases.

CO-4: Understand the techniques of radio spectrum allocation in multi-user systems and their impact on networks capacity.

CO-5: Understand how the various signal processing and coding techniques of GSM and its Architecture.

Text Books:

1. J. Schiller, "Mobile Communications", Pearson Education, Delhi, 2ndedition, 2013.
2. Hansmann, Merk, Nicklous, Stober, Principles of Mobile Computing, 2nd Edition, Springer India, 2004.

Reference Books:

1. Pahalavan, Krishnamurthy, Principle of wireless Networks: A unified Approach, Pearson Education, Delhi,2003.
2. Martyn Mallick, Mobile and Wireless Design Essentials, WileyDreamtech India Pvt. Ltd., New Delhi,2004.
3. W.Stallings, Wireless Communications and Networks, 2nd Edition, Pearson Education, Delhi,2004.

Web Sources:

1. www.nptel.ac.in
2. www.nescoacademy.com

R PROGRAMMING 4 0 0 4

Course Objective

To provide a basic understanding of R programming, data structures, functions, how to work with packages, files and know about the data visualization and data management techniques.

UNIT I INTRODUCTIONTO R 12

Overview of R programming - Evolution of R - Applications of R programming - Basic syntax - Basic Concepts of R: Reserved Words, Variables & Constants, Operators, Operator Precedence, Data Types, Input and Output - Data structures in R: Vectors, Matrix, List in R programming Data Frame, Factor.

UNITII FUNCTIONS 12

Control flow - If...else, If else() Function - Programming for loop - While Loop, Break & next,RepeatLoop-Functions-RFunctions-FunctionReturnValue–Environment&ScopeR Recursive Function R Infix Operator - R Switch Function - Strings: String construction - rules - String Manipulation functions.

UNIT III PACKAGESAND RESHAPING 12

R packages - Study of different packages in R - R Data Reshaping: Joining Columns and Rows in a Data Frame - Merging Data Frames - Melting andCasting.

UNIT IV FILES AND ROBJECTS CLASS 12

Working with files - Read and writing into different types of files - R object and Class Object and Class: R S3 Class - R S4 Class R Reference Class - R Inheritance.

UNIT V DATA VISUALIZTION ANDDATA MANAGEMENT 12

Data visualization in R and Data Management - Bar Chart, Dot Plot, Scatter Plot (3D), Spinning Scatter Plots, Pie Chart - Histogram (3D) [including colorful ones], Overlapping Histograms – Boxplot, Plotting with Base and Lattice Graphics Missing Value Treatment - Outlier Treatment - Sorting Datasets - Merging Datasets - Binning variables.

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate functions in R and implement simple iterative algorithms.

CO-2: Analyze probability distribution tools such as ANOVA.

CO-3: Apply to implement simple algorithms in R independently

CO-4: Apply visualization techniques in R in an efficient way.

CO-5: Understand the basics of R programming including matrix and vectors etc.

Text Books:

1. Norman Matloff , "The Art of R Programming-a tour of statistical software design", William Pollock,2011.
2. Paul Teetor "R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics", O'Reilly Cookbooks, O'Reilly Media ,2011.

Reference Books:

1. Rob Kabacoff, "R in Action Book", Manning Publications Co,2011.
2. Nina Zumel , John Mount , Jim Porzak, "Practical Data Science with R", Dreamtech, 2014.
3. Richard Cotton, "Learning R: A Step-by-Step Function Guide to Data Analysis", O'Reilly Media,2013.

Web Sources:

1. www.statmethods.net/r-tutorial/
2. http://www.r-tutor.com/

ARTIFICIAL INTELLIGENCE 4 0 0 4

Course Objective:

The course will address key AI technologies in an attempt to help in understanding their role in cyber security and the implications of these new technologies to the world of politics. AI deficiently will complement and strengthen the cyber security practices and will improve their applications in enhancing our security.

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 12

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems-Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – ConstraintPropagation–BacktrackingSearch–GamePlaying–OptimalDecisionsinGames–Alpha– Beta Pruning – Stochastic Games.

UNIT II SOFTWARE AGENTS AND APPLICATIONS 12

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems- AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – MachineTranslation–SpeechRecognition–Robot–Hardware–Perception–Planning–Moving.

UNIT III CYBER SECURITY VULNERABILITIES ANDSAFEGUARDS 12

Cyber Security Vulnerabilities-Overview- vulnerabilities in software-System administration-Complex Network Architectures- Open Access to Organizational Data-Weak Authentication- Unprotected Broadband communications-Poor Cyber Security Awareness- Cyber Security Safeguards- Access control- Cryptography- Deception-Denial of Service Filters-Ethical Hacking- Firewalls-Intrusion Detection Systems- Threat Management.

UNIT IV SECURING WEB APPLICATION, SERVICES AND SERVERS 12

Basic security for HTTP Applications and Services- Basic Security for SOAP Services- Identity Management and Web Services- Authorization Patterns- Security Considerations- Challenges - Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software- Botnet detection-Spam filter applications-Hacking incident forecasting-cyber security ratings.

UNIT V CYBER FORENSICS AND CASE STUDIES **12**

Introduction to Cyber Forensics- Conducting disk-based analysis- Investigating Information-hiding-Scrutinizing E-mail- Tracing Internet access- Tracing memory in real-time-Case study: Cyber Security Regulations- Roles of International Law- Cyber Security Standards-The INDIAN Cyberspace- National Cyber Security Policy2013.

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Create self-learning and research skills to tackle a topic of interest on his/her own or as part of a team.

CO-2: Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions.

CO-3: Analyze the dimensions along which agents and environments vary, along with key functions that must be implemented in a general agent.

CO-4: Understand the concepts of Artificial intelligence

CO-5: Understand major challenges and the complexity of AI problems.

Text Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, 2010.
2. James Graham, Richar Howard,Ryan Olson, "Cyber Security Essentials", CRC Press, Tailor and Francis Group, 2011.
3. Nina Godbole, Sunit Belapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Publications, April, 2011.

Reference Books:

1. Patterson, Introduction to Artificial Intelligence & Expert Systems, PHIPoole, Computational Intelligence, OUP,2012
2. Saroj Kaushik, Logic & Prolog Programming, Saroj Kaushik, New Age International Expert Systems, Giarranto, VIKAS, 2014

Web Resources:

1. www.edureka.com
2. www.towardsdatascience.com

EMBEDDED SYSTEM 4 0 0 4

Course Objective

To learn parallel and distributed algorithm's development techniques for shared memory and message passing models. To study the main classes of parallel algorithms. To study the complexity and correctness models for parallel algorithms.

UNIT I INTRODUCTION TOEMBEDDED SYSTEMS 12

Definition of Embedded System - Embedded Systems Vs General Computing Systems - History of Embedded Systems - Classification, Major Application Areas - Purpose of Embedded Systems - Characteristics and Quality Attributes of Embedded Systems.

UNIT II TYPICALEMBEDDEDSYSTEM: 12

Core of the Embedded System - General Purpose and Domain Specific Processors - ASICs, PLDs, Commercial Off- The Shelf Components (COTS) - Memory - ROM, RAM - Memory according to the type of Interface - Memory Shadowing - Memory selection for Embedded Systems - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces.

UNIT III EMBEDDED FIRMWARE 12

Reset Circuit - Brown-out Protection Circuit - Oscillator Unit - Real Time Clock - Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

UNIT IV RTOS BASED EMBEDDEDSYSTEMDESIGN 12

Operating System Basics - Types of Operating Systems – Tasks - Process and Threads - Multiprocessing and Multitasking - Task Scheduling.

UNIT V TASKCOMMUNICATION 12

Shared Memory - Message Passing - Remote Procedure Call and Sockets - Task Synchronization: Task Communication/Synchronization Issues - Task Synchronization Techniques - and Device Drivers - Case-Study: How to Choose an RTOS.

Total: 60 hours

Course Outcome

At the End of this course, the Student will be able to:

CO-1: Apply concept of Embedded system and General Computing systems.

CO-2: Understand the History and Classification of Embedded systems.

CO-3: Understand the Major Application Areas, Purpose of Embedded Systems.

CO-4: Understand about the Core of the Embedded System.

CO-5: Understand of General Purpose and Domain Specific Processors.

Text Books:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill., 2009
2. Raj Kamal, "Embedded Systems", TMH, 2nd edition,2008.
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley,2002.

Reference Books:

1. Lyla, "Embedded Systems", Pearson,2013.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, Ist Edition, 2002.

Web Sources:

1. www.tutorialandexample.com/embedded-systems-tutorial/
2. www.studyelectronics.in/embedded-programming-tutorial

SECURITY ISSUES IN MACHINE LEARNING 4 0 0 4

UNIT I INTRODUCTION TO MACHINE LEARNING 12

Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net)

UNIT II CLASSIFICATION AND REGRESSION ALGORITHMS 12

Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural NetworksLearning And Generalization, Overview of DeepLearning.

UNIT III SECURITYIN MACHINE LEARNING 12

Security Vulnerabilities in Machine Learning Algorithms, Evasion Attacks (Adversarial Inputs), Data Poisoning Attacks, Model Stealing Techniques, Possible Solutions to Ensure Machine Learning Security

UNIT IV ADVANCED LEARNING 12

Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Computational Learning Theory – Mistake Bound Analysis – Reinforcement learning – Markov Decision processes, Deterministic and Non- deterministic Rewards and Actions, Temporal Difference LearningExploration.

UNIT V CASE STUDY 12

Possible case studies: Machine learning for intrusion detection, Machine learning for side channel analysis, Privacy preserving machine learning, Adversarial machine learning.

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Evaluate concepts of machine learning.

CO-2: Analyze appreciate supervised and unsupervised learning and their applications

CO-3: Analyze security issues in machine learning.

CO-4: Understand the analysis of time series and overview of deep learning.

CO-5: Understand the security issues in machine learning.

Text Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer,2007.
2. KevinP.Murphy,“MachineLearning:AProbabilisticPerspective”,MITPress,2012.
3. EthemAlpaydin,“IntroductiontoMachineLearning”,MITPress,ThirdEdition,2014.

Tom Mitchell, "Machine Learning", McGraw-Hill,1997.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition,2011.
2. Stephen Marsland, “Machine Learning - An Algorithmic Perspective”, Chapman and Hall/CRC Press, Second Edition,2014.

Web Sources:

1. www.analyticsvidhya.com/blog/2018/07/using-power-deep-learning-cyber-security/
2. www.simplilearn.com/how-ai-and-machine-learning-impact-cyber-security-article

Syllabus
Generic Electives

HUMAN RESOURCE MANAGEMENT 4 0 0 4

Course Objective

To teach relevant, practical and applicable human resource management skills to equip the student with the foundation competencies for working as HR practitioners in business. To highlight the important challenges facing managers and employees in today's business climate. To introduce contemporary theory and practice in modern human resource management and the range of tools and methods available to address HR challenges and problems.

UNITI HUMANRESOURCE MANAGEMENT 12

Meaning - Scope & Objectives of HRM - Evolution of HRM - Difference between PM & HRM - HRM function's - HR as a Strategic Business Partner - HR Policy & procedures - Competitive challenges influencing HRM Qualities & qualification of HR Manager - Roles and Responsibilities of HR Manager / Departments.

UNIT II HUMANRESOURCE PROCESS 12

Human Resource Planning – Job Analysis and Design - Recruitment - Selection and placement process – Types of interviews – Placement - Orientation & Induction - Determining training needs - Training Approaches - Separation process & Exit interview.

UNIT III MANAGINGCAREERS 12

Career Development vs. Employee development - Career stages – Career Choices and Preferences - Mentoring and Coaching - Time Management.

UNIT IV PERFORMANCE MANAGEMENT 12

Purposes of Performance Management - Performance Appraisal Methods - Punishment and Promotion, Job evaluation - Wage & Salary administration – Concepts - Pay structure - Incentives – Bonus - Insurance.

UNIT V CONTEMPORARY ISSUESIN HRM 12

Talent Management - Competency Mapping - Industrial Relations – Health & Safety issues - grievance handling - D Work Life Balance - Quality of Work Life - HRD in India - International HRM.

Total: 60 Hours

Course Outcome

At the End of this course, the Student will be able to:

CO-1: Analyze the emerging trends, opportunities and challenges in performance appraisal.

CO-2: Assess the major HRM functions and processes of HRM planning, job analysis and design, recruitment, selection, training and development, compensation and benefits, and performance appraisal.

CO-3: Apply the Concept of job application and how it is practically applied in the organization.

CO-4: Understand various recent techniques related to HRM.

CO-1: Understand History and evolution of HRM.

Text Books:

1. Aswathappa.K, "Human Resource Management, Text and Cases", Tata McGraw Hill, New Delhi,2014.
2. Gupta. S.C, "Advanced Human Resource Management, Strategic Perspective", ANE Books Pvt. Ltd, New Delhi,2009.

Reference Books:

1. Angela Baron and Michael Armstrong, "Human Capital Management (Achieving Added Value Through People)", Kogan Page Limited, United States,2007.
2. Anuradha Sharma and Aradhana Khandekar, "Strategic Human Resource Management", Response Books, New Delhi,2006.
3. Beer et al, "Managing Human Assets", The Free Press: Maxwell Mac Millan Inc, New York,1984.
4. Dreher Dougherty, "Human Resource Strategy: A behavioral perspective for the General Manager", McGraw – Hill Higher Education, Singapore,2001.

Web Sources:

1. www.hrmexam.com/hrm-tutorial/
2. www.youtube.com/watch?v=aA1OlFHZWtU

SOCIALNETWORKING 4 0 0 4

Course Objective

The Students should be able to understand the concept of sematic web and related applications by acquiring adequate knowledge from ontology. The students will also be able understand the human behavior in social web and visualizing the social networks.

UNIT 1 INTRODUCTION 12

Introduction to Semantic Web - Limitations of current Web – Development of Semantic Web– Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNITII MODELLING, AGGREGATING AND KNOWLEDGEREPRESENTATION 12

Ontology and their role in the Semantic Web - Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 12

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 – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR ANDPRIVACYISSUES 12

Understanding and predicting human behavior for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online

environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and counter measures.

UNIT 5 VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS12

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-citation networks.

Total: 60 Hours

Course Outcome

At the End of this course, the Student will be able to:

CO-1: Apply the basic knowledge's and limitations of semantic web.

CO-2: Apply Electronic sources for network analysis, various information's about blogs and online communities can be learned.

CO-3: Apply Ontology based semantic web modelling and aggregation for social network can be deeply grasped by students.

CO-4: Understand basic knowledge about web social networks with detailed extraction evolution of web communities can be learned.

CO-5: Understand various applications of community mining algorithms with tools for detecting social network infrastructures.

TextBooks:

1. Peter Mika, "Social Networks and the Semantic Web", Ist Edition, Springer2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer,2010.

Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", 1st Edition Springer,2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.

3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, “The Social Semantic Web”, Springer,2009.

Web Sources:

1. www.simplilearn.com/social-media-tutorial-video
2. www.udemy.com/course/meteor-tutorial/

GEOGRAPHICAL INFORMATION SYSTEM 4 0 0 4

Course Objective

GIS is a combination of software and hardware with capabilities for manipulating, analyzing and displaying spatially-referenced information. By linking data to maps, a GIS can reveal relationships not apparent with traditional item-referenced information systems and data base management products, and by displaying information in a graphic form can communicate complex spatial patterns succinctly. The course emphasizes the concepts needed to use GIS correctly and effectively for manipulating, querying, analyzing, and visualizing spatial-based data.

UNIT I INTRODUCTION TO GIS 12

What is GIS - What GIS can do - Types of GIS projects - Remote sensing, GPS, SDSS Continental Drift – Representing Geography - Geographic Representations - Nature of Geographic Data - Spatial Autocorrelation - Spatial Sampling - Georeferencing - Global Navigation Systems.

UNIT II CREATING, MAINTAINING AND USING GEOGRAPHICDATABASES 12

GIS Data Collection and Correction - Geographic Databases - Accessing Geographic Data - Distributed GIS- Geographic Data Analysis : Geovisualization - Vectors and Rasters - Measurement and Transformation- Uncertainty in GIS - ArcGIS : Exploring ArcGIS - Spatial Data - Metadata - ArcCatalog -ArcToolbox.

UNIT III WORKING WITH ARCMAP 12

Map documents - Windows and Menus - Help system - Data frames – Layers - Symbols and styles - Map scales and labeling - Coordinate Systems and Map Projections - Map projections and GIS - Coordinate Systems - Spheroids and datums - Common projection systems - Projecting data. Basic Editing in ArcMap : Editing overview - The EditorToolbarSnapping features - Creating adjacent polygons - Editing features - Editing attributes – Saving work.

UNIT IV COORDINATE SYSTEMS AND MAP PROJECTIONS 12

Map projections and GIS - Coordinate Systems - Spheroids and datums – Com mon projectionsystems-Projectingdata-DrawingandSymbolizingFeatures-

TypesofmapsClassifying numeric data - Using map layers - Editing symbols and using styles – Displaying rasters.

UNIT V WORKING WITH TABLES **12**

Tables - Joining tables - Statistics - Summarizing tables - Editing and calculating tables - Queries - What are queries - Selecting - Using queries in GIS analysis - Spatial Joins - Types of joins - Setting up a spatial join - Spatial Data Modeling: Types of Models - Tools for Modeling – Future GIS – Case study with GIS.

Total: 60 hours

Course Outcome:

At the End of this course, the Student will be able to:

CO-1: Analyze the fundamental concepts of geographic information systems and their differences from other types of information systems.

CO-2: Apply Utilize modern industry-standard GIS software for conducting basic GIS analyses and producing cartographic output.

CO-3: Apply predominantly using ESRI's ArcGIS software .

CO-4: Apply critical thinking skills in solving geospatial problems.

CO-5: Understand competency with the ArcMap software to enhance and interpret data.

Text Books

1. Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W.Rhind, " Geographic Information Systems and Science", 4th Edition, John Wiley & Sons, 2012.
2. O'Sullivan, D. and D. Unwin , "Geographic Information Analysis", 2nd Edition, John Wiley and Sons,2010.

Reference Books:

1. Longley, Goodchild, Maguire, Rhind, " Geographic Information Systems and Science", 2nd Edition, Wiley,2005.
2. Gorr, W and Kurland K. " GIS Tutorial: Workbook for ArcView 9", ESRI Press, 2005.

Web Sources:

1. www.gisgeography.com/what-gis-geographic-information-systems/
2. www.coursera.org/specializations/gis

TECHNICAL WRITING IN COMPUTER SCIENCE 4 0 0 4

Course Objectives:

This course is designed to develop skills that will enable to produce clear and effective scientific and technical documents. While the emphasis will be on writing, oral communication of scientific and technical information will form an important component of the course, as well.

UNIT I INTRODUCTION 12

Foundation of Reading & Writing - Introduction to Technical Writing- Introduction to research papers - articles, technical notes - Document Development Life Cycle - Software Tools (Latex, etc.) - concept of technical publication

UNIT II KNOWLEDGE ABOUT TECHNICAL WRITING 12

Documentation development life cycle: Role of a Technical writer- Principles of Technical Writing, Documentation deliverables - Printed documentation and Online Help Systems - Working with images and illustrations -Characteristics of Technical Writing - Measures of Excellence in Technical Documents - The Content Approach - Acquiring the Three Types of Knowledge - Understanding Audience and Purpose - Collaborative Writing - Writing for Multiple Audiences

UNIT III ORGANIZING THE INFORMATION 12

Introduction – Visuals - Technical definition – Extensions - Mechanism Description - Mechanism in Operation - Planning Stage - Technical Writing Process: Document development process - Estimating Technical Documentation - Documentation Planning - Selection of Tools - Information Architecture - Templates and Page design - Audience Profiling Task Analysis - Content Development - Elements of Style - Technical Reviews - Editorial Reviews - Formatting and pagination - Document Conversions - Content Publishing - Quality Control - Content Maintenance

Unit IVRESEARCHING YOUR SUBJECT 12

Academic vs. Workplace Research - Conducting Secondary Research - Primary Research - Focus on Process - Laboratory Report - Feasibility, recommendation, and evaluation reports – Instructions - Checklist for the technical report - Style of writing -Grammar and Editing English Grammar - Punctuation and Mechanics - MS Style Guides & Proof Reading

UNIT V CASE STUDY 12

Design Specification, User Manual / Guides, Hardware Manuals, Installation Manuals,

Online Help, Web sites, Analytical/Feasibility Reports, Proposals (Business Development Perspective), Lab/ScienceReports, Project proposal writing, Abstracts, Progress reports.

Total: 60 Hours

Course Outcomes:

At the End of this course, the Student will be able to:

CO-1: Analyze basic concepts of technical writer**.**

CO-2: Analyze issues related to workplace research that you will have to conduct as a technical writer**.**

CO-3: Apply graphical tools that you can use to design visuals with the output process of the report in mind

CO-4: Apply visuals to communicate a large amount of information quickly and efficiently.

CO-5: Understand issues related to various types of academic and workplace research.

Text Books:

1. Markel, Mike. Technical Communication. 7th ed. New York, NY: Bedford/St. Martin's, ISBN: 9780312403386,2003

Reference Books:

1. Diana. A Pocket Style Manual. 4th Ed. New York, NY: Bedford/St. Martin's, 1999. ISBN: 9780312406844, 2014
2. Perelman, Leslie C., James Paradis, and Edward Barrett. The Mayfield Handbook of Technical and Scientific Writing. New York, NY: McGraw-Hill. ISBN: 9781559346474, 2011

Web Sources:

1. www.instructionalsolutions.com/blog/become-a-technical-writer
2. www.nptel.ac.in

SYLLABUS

SKILL ENHANCEMENT COURSES

SOFTSKILLS – I **- 2 0 0 2**

Course Objective:

- To enable participants Business Communication Skills
- To enhance participants E-mail writing skills
- To impart Leadership and Team Bonding skills

Credit Hours

1. READING COMPREHENSION AND VOCABULARY **06**

Filling the blanks – Cloze Exercise – Vocabulary building – Reading and answering Questions.

2. LISTENING AND ANSWERING QUESTIONS. **06**

Listening and writing – Listening and sequencing sentences – Filling in the blanks – Listening and answering questions.

3. GROUP DISCUSSIONS **06**

Why GD part of a selection process – Structure of a GD – strategies in GD – Team Work – Body Language

4. CONVERSATION. **06**

Face to face Conversation and Telephone conversation.

5. SELF- INTRODUCTION AND ROLE PLAY **06**

Total **30 Hours**

Course Outcome

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

CO 1 Prioritize power of understanding and aids assimilation of vocables. Vocabulary to charge communication with educated words

CO 2 Develop comprehensive knowledge through listening leading to answering questions

CO 3 Build observation power and infuse self-confidence through group discussions

CO 4 Identify methodology for befitting constructional ability

CO 5 Experiments with inward looking and visualization of the 'otherness' of situations

Books Recommended

- Barun K. Mitra. Personality Development and Soft Skills. Oxford University Press. New Delhi.2011.
- S.P. Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.
- Tiko, Champa & Jaya Sasikumar. Writing with a Purpose.OUP. New Delhi. 1979

Web Source:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://blog.smarp.com/top-5-communication-skills-and-how-to-improve-them
- https://blog.hubspot.com/service/phone-etiquette

SOFT SKILLS – II **- 2 0 0 2**

Course Objective:

- To enable students to develop their communication skills effectively
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence through communication

Credit Hours

1. PRESENTATION SKILLS **06**

Elements of an effective presentation – structure of presentation – voice modulation – Audience analysis – Body language

2. SOFT SKILLS **06**

Time Management – Articulateness – Assertiveness – Stress management

3. RESUME / REPORT PREPARATION / LETTER WRITING **06**

Structuring the resume / Report – Business letters – E-Mail Communication

4. INTERVIEW SKILLS **06**

Kinds of Interviews – Required by Skills – Corporate Culture – Mock Interviews

5. 30 FREQUENTLY ASKED QUESTIONS **06**

Total **30 Hours**

Course Outcome

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

CO1 Illustrate the essential of presentation skills, thoughts, structure, voice modulation, audience analysis and body language

CO2 Utilize the psychological skills pertaining to time management, articulation, assertion and stress management

CO3 Construct methodology for preparation of resume, reports, business letters and email communication

CO4 Appraise learners with varied skills needed for expose to interviews

CO5 Categorize the nature of questions asked usually in interviews

Books Recommended

- Barun K.Mitra. Personality Development and soft skills. Oxford University Press. New Delhi. 2011.
- S P Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.
- Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.businessnewsdaily.com/5836-top-interviewing-skills.html
- https://gdpi.hitbullseye.com/Group-Discussion.php

SOFT SKILLS III **2 0 0 2**

Course Objective:

- To enable students to develop their soft skills and Body Language
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence to excel at Interviews

	Credit Hours
UNIT–I	**06**
Powerful Presentation	
UNIT–II	**06**
Reinforcement	
UNIT–III	**06**
Using visual aids	
UNIT–IV	**06**
Types and Methods of Presentations	
UNIT–V	**06**
Obstacles to Presentation	
Total	**30 Hours**

Course Outcome:

CO1 To develop participants social and professional skills
CO2 To help participants manage time effectively
CO3 To build a strong resume to suit corporate requirements
CO4 To face interviews confidently
CO5 To enhance their aptitude abilities

Books Recommended:

- Roz Townsend: Presentation Skills for the Upwardly Mobile, Emerald, Chennai.
- Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.
- Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://venngage.com/blog/presentation-skills/
- https://gdpi.hitbullseye.com/Group-Discussion.php