SYLLABUS

FOR

Master of Science in Computer Science

With Specialization

in

Indigenous Knowledge, Science and Technology

(IKST)

Choice Based Credit System (CBCS)

With Effect From Academic Session: 2021-2022

KALINGA INSTITUTE OF SOCIAL SCIENCES (KISS)
(Deemed to be University)
Bhubaneswar, Odisha

INTRODUCTION

Indigenous scientific knowledge and technology were developed in a symbiotic relationship with Nature. Indigenous people have had an innate understanding of natural resources available in our ecosystem, but it was in a supine state over the years. In the present age of globalization, the tribes who are the custodians of indigenous knowledge and technology in a real sense are far behind in the race of advancement.

Gradual developments of such people in varied facets of life enable them to explore their traditional knowledge for human welfare. As the over-exploitation of natural resources threatens the ecological balance and sustainable livelihood of tribal people, it is imperative to study our time-tested indigenous knowledge and tribal technology with greater vigour.

Hence, an innovative School – **School of Indigenous Knowledge, Science and Technology** – has been set up to promote, preserve and protect indigenous knowledge and implement it for sustainable development.

The importance of this School is to disseminate advanced knowledge by providing instructional and research facilities in tribal medicinal systems through phytochemical analysis, geosciences and their impact on the health conditions. The importance of cosmology in their culture, Sutras and sub-sutras of Vedic mathematics, a nutritional component of the food habit of tribes, intellectual property rights to preserve and conserve the biodiversity of indigenous people and advancement in technologies relating to the natural resources of the tribal areas as well as in other branches of learning as it may deem fit.

This could be possible by teaching innovative courses in *Indigenous Knowledge and Intellectual Property Rights*, *Tribal Sports*, *Nutrition and Health Management*, *Indigenous People and the Science of Gemology*, *Indigenous People and the Science of Cosmology* and *Vedic Mathematics*. The courses attempt to examine indigenous knowledge and technology, blending both traditional and modern scientific methods from interdisciplinary and multidisciplinary approaches.

VISION:

Be an internationally acclaimed School, recognized for excellence in teaching, research, consultancy and outreach; skill development and social entrepreneurship for tribal youth by promoting Indigenous Science and Technology.

MISSION:

- Foster all-around development of students through multi-faceted education.
- Focus on Indigenous Science and Technology with the help of innovative courses like Indigenous people and the Science of Cosmology, Vedic Mathematics, Indigenous people and the Science of Gemology, Tribal Sports, Nutrition and Health Management, Indigenous Knowledge and Intellectual Property Rights.
- Engage with local, national and global communities to get ideas about Indigenous Science and Technological applications for contemporary needs and problems and become successful in life.
- Manage resources self-employment and create employment for others.

M.Sc. in Computer Science with specialization in Indigenous Knowledge, Science and Technology

This programme intends to offer courses that deal with economic poverty alleviation measures through the management of indigenous resources and meet the goals of sustainable development. The programme is inter-disciplinary, and it focuses on the sustenance of natural/human resources by employingtraditional methods that are conducive to societal growth and development.

Process of Revision of Courses through stakeholder inputs:

The School of Indigenous Knowledge, Science and Technology follows the consultative process in the revising of the courses.

Following are the stages of course revision:

(i) Formation of syllabus Revision Committee with members having specialized domain knowledge.

(ii) Consultation with stakeholders comprising alumni, students, employers, etc.

(iii)Approval by all faculty members of the Department

(iv)Approval by Board of Studies (Experts from Outside) and Academic Council

Introduction to CBCS (CHOICE BASED CREDIT SYSTEM)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective, skill-based courses. The courses can be evaluated following the grading system. Grading system provides uniformity in the evaluation and computation of the

Cumulative Grade Point Average (CGPA) based on student's performance in examinations which enables the student to move across institutions of higher learning. The uniformity in evaluation system also enables the potential employers in assessing the performance of the candidates.

Definitions:

(i) **'Academic Programme'** means the entire course of study comprising its programme structure, course details, evaluation schemes etc. designed to be taught and evaluated in a teaching programme or jointly under more than one such Programme.

(ii) **'Course'** means a segment of a subject that is part of an Academic Programme.

(iii) **'Course Structure'** means a list of courses (Core, Specialization, Discipline Specific Elective, MOOC/Open Elective and skill based) that makes up an Academic Programme, specifying the syllabus, Credits, hours of teaching, evaluation and examination schemes, minimum number of credits required for successful completion of the programme etc. prepared in conformity to University Rules, eligibility criteria for admission.

(iv) **'Core Course'** means a course that a student admitted to a particular programme must successfully complete to receive the degree and which cannot be substituted by any other course.

(v) **'Discipline Specific Elective'** Courses offered in the same Programme of the School.

(vi) **'Specialization'** means a course to be taken by a student offered in the Programme of the School.

(vii) **'Open Elective Course'** means an elective course which is available for students of all programmes, including students of same department and the Students of other Programme will opt these course.

(viii) **'Skill Enhancement Courses'** means the skill-based courses and are aimed at providing hands-on-training, competencies, skill- based knowledge.

(ix) **'Credit'** means the value assigned to a course which indicates the level of instruction; One hour lecture per week equals 1 Credit, 2 hours practical class per week equals 1 credit.

(x) **'SGPA'** means **'Semester Grade Point Average'** calculated for individual semester and **'CGPA'** is **'Cumulative Grade Points Average'** calculated for all courses completed by the students at any point of time. CGPA is calculated each year for both the semesters clubbed together. To benefit the student, a formula for conversation of Grand CGPA into percentage marks is given in the Transcript.

Programme Details:

As per the structure, there are five to six courses in all semesters. In addition, as per the area of interest, the students are required to choose discipline specific elective, in the beginning of the 4th semester. Under Choice Based Credit System, students will also study 'Open Elective' courses. These courses will be available for students. The programme also offers career advancement and skill enhancement course in each semester as value added courses to equip the students in the competitive market. In the light of augmentation in the field of Indigenous Science and Technology, the overall structure of the course has been changed to widen the scope and depth of the course and inclusion of research paradigms of Indigenous Science and Technology, Chemistry, Physics, Mathematics and Computer Science to facilitate those students aspiring for pursuing research. The course has been designed in line with outcome based approach which requires specification of Course Objectives and Course Outcomes.

This programme structure offers a deep dive into various facet of Indigenous Science and Technology and organizational development by integration of cross-cutting issues relevant to environment and sustainability, human values, professional ethics, into the curriculum through incorporation of relevant topics such as Indigenous Knowledge and Intellectual Property Rights, Tribal Sports, Nutrition and Health Management, Indigenous People and the Science of Gemology, Indigenous People and the Science of Cosmology and Vedic Mathematics. The curriculum seeks to develop managerial knowledge and strategic agility, providing students with a broader skill set and a fresh perspective and to encourage them.

Programme Educational Objectives (PEOs):

The Objective of this program is to ensure career path of the students. Students can be self employed in the tribal community or elsewhere; or become a social entrepreneur; or can adopt research studies to enhance their skills for sustainable livelihood and become a researcher; they can pursue higher studies; or become a professional for policy making and its execution.

PEO1: To enable the students to learn, evaluate and develop analytical ability mainly in the field of science and technology and to ensure preservation of tribal resources. They should be able to highlight the philosophical approach of the tribals towards economic life.

PEO2: To explore and innovate scientific knowledge through the application of indigenous knowledge by utilizing the treasured indigenous knowledge of Professors of Practice.

PEO3: To collaborate with national and international universities and organizations, especially for undertaking spiritual studies and research on tribal communities

PEO4: To provide strong domain knowledge along with skill enhancement through hands-on training. To provide experiential training to students for professional and career readiness to participate in real life projects and develop the right skill-set needed in a competitive market scenario.

PEO5: To offer online and offline certificate courses for enrichment and refinement of their skills and computer literacy for attaining global competency.

PEO6: To formulate tribal centric development models, publish reports and organize conferences and seminars on issues relating to indigenous science and technology.

PEO7: To create ample scope for the researchers in the field of science and technology from a tribal perspective by integrating relevant aspects of indigenous knowledge with traditional subjects like Physics, Chemistry, Mathematics and Computer Science.

PEO8: To make proper use of natural resources and indigenous knowledge for sustainable environmental development.

PEO9: To equip the students with knowledge in indigenous science and technology and turn them into agents of social transformation in their respective communities.

PEO10: To strive for continuous quality enhancement of academic and institutional governance to promote a culture of credibility, transparency and reliability.

Learning Outcome-based Curriculum Framework (LOCF)

This Learning Outcome-based Curriculum Framework (LOCF) in M. Sc. for the SIKST are as follows:

1. **Introduction**

   Postgraduate education in Chemistry in KISS University aims at overall development of the rural and tribal community and sustainable tribal development. The focus is on knowledge and skills that prepare students for further study, employment, and research.

2. To achieve the programme goals, following measures shall be adopted:

   i. Reform based on a Learning Outcomes-based Curriculum Framework (LOCF)
   ii. Enriching the quality of teaching and research
   iii. Enlightening learning environment through ICT based hands-on approach to students
   iv. Involving students in discussions, problem-solving, and out of the box thinking
   v. Motivating the students to understand various concepts of chemistry and apply them in real life situations.

The salient features of the Learning Outcome-based Curriculum Framework (LOCF) detailed in this syllabus of M.Sc.Computer Science with specialization in Indigenous Knowledge, Science and Technology (IKST) is as follows:

1) The objectives of this framework are to mentally prepare the students to learn various courses/ subjects in the domain of Computer Science leading to postgraduate degree of KISS Deemed to be University.
2) The learning outcomes for each course have been carefully designed to help students to have experiential learning in various domains of the Computer Science discipline.
3) Proper care has been taken to include in the course contents the United Nations 2030 Agenda for Sustainable Development Goals and have integrated them into the courses viz., Indigenous People and the Science of Gemology, Indigenous People and the Science of Cosmology and Vedic Mathematics and integrating them in the basis domains integrate courses covering various domains like Physics, Chemistry, Mathematics and Computer Science, Vocational and Life Skills, etc.
4) The core courses have been selected considering the need for studying Computer Science with discipline specific electives and the required theoretical knowledge and practical exposure.
5) To achieve the spirit of LOCF under CBCS and to empower the students, large numbers of optional courses under Discipline Specific Elective (DSE) have been included in the structure. This course structure also includes MOOCs, Open Elective Courses and Skill Enhancement Courses. All courses have been developed to encompass domain knowledge and skills, facilitating students to interface with various sections of society so that they can lead a professional life.
6) Keeping in view the objectives and learning outcomes of each course, proper care has been taken, to provide working knowledge for each unit in the course so that the students can gain hands-on experience (learning by doing).
7) A Summer Internship of 3 weeks' duration has been included in this structure after the second Semester. This would be followed by the submission of a Project Report and a Viva-voce examination.
8) Project Work and Dissertation has been provided in the fourth semester involving the application of knowledge in the matter of exploring/analyzing/solving issues in real-life

situation. The course is designed keeping in view the employability, research, and innovation in the field of Computer Science and Indigenous Science and Technology.

9) The faculty members while delivering a lecture in a classroom situation shall use ICT-basedteaching-learning pedagogy and various interactive teaching and learning techniques like case studies, simulation, presentation, assignment, quiz, group discussions etc., to have continuous learning engagement of the students and effective teaching learning process. Focus is on character building of students, development of holistic personality, their values and ethics, etc., are the prime focus in the teaching learning process so that they become good global citizens.

Programme Outcomes (POs):

The expected graduate attributes for a postgraduate from the School are:

1) Disciplinary Knowledge
2) Inquiry-oriented approach
3) Professional Skills
4) Self-directed Life–long learning
5) Engagement with the needs of Society
6) Communication Skills
7) Initiative and innovative ability

The Programme Outcomes (POs) based on the Graduate Attributes are -

	Attributes	**Description**
PO1	Disciplinary Knowledge	Acquire an understanding of the nature, practice and application of the chosen area of study
PO2	Inquiry oriented approach	Develop an understanding of the scientific method of evidence-based knowledge acquisition, deduction, inference, and induction. Including problem-solving, critical thinking & analysis and the ability to discover new knowledge
PO3	Professional Skills	To acquire, develop, employ and integrate

		a range of technical, practical and professional skills, in appropriate and ethical ways within a professional context, autonomously and collaboratively and across a range of disciplinary and professional areas. This includes not only subject specific skills such as laboratory skills, computing skills or quantitative data handling skills, but also more generic skills such time management, personal organization, teamwork and negotiation.
PO4	Self-directed Life–long learning	Develop the capacity to engage in reflection and learning beyond formal educational contexts, that is based on the ability to make effective judgments about one's own work and to undertake self-directed, curiosity motivated, learning. The capacity to learn in, and from, new disciplines to enhance the application of scientific knowledge and skills in professional contexts.
PO5	Engagement with the needs of Society	To build an awareness of the role of science within a global culture and willingness to contribute to the shaping of community views on complex issues where the methods and findings of science are relevant. This includes an understanding of how science underpins society, the applications of science in different cultures and identifying and engaging with current and future challenges.
PO6	Communication Skills	To develop an understanding of, and

		ability with the different forms of communication - writing, reading, speaking, listening-including visual and graphical, within science and beyond and the ability to apply these appropriately and effectively for different audiences.
PO7	Initiative and innovation	Acquire an ability to think and work creatively, including the capacity for self-starting, and the ability to apply science skills to unfamiliar applications. It encompasses skills such as understanding risk management and risk-taking, “thinking outside the box”, and questioning the norm to suggest new solutions for old problems.

The programme specific outcomes (PSOs)are:

PSO1: Students will be able to adapt the skills to implement effective solutions for need-based problems by applying knowledge gained through different programming languages, tools and software covered in the syllabus of programme.

PSO2: Student will be able to learn working and type of operating systems, distributed operating systems, its process, memory and file management which enables them to take appropriate optimized decisions for applying necessary algorithms.

PSO3: Students will be able to handle network related problems by studying data communication network, network security courses. Students learn to troubleshoot fault detection in combinational switching circuits, learn and utilize the concepts of mobile communications.

PSO4: Students will be able to learn and apply the concepts of software engineering which is essentially important while working on big modules and or projects.

PSO5: Students will be able to apply and implement the working of compilers which also tends them towards system programming.By using various components students will be able to implement a efficient scalable software solution in the form of web or windows application.

PSO6: Students are prepared for research-oriented concepts of data mining and data warehousing. Student will learn the necessity and importance of data pre-processing, data integration, data discretization. Students learn the concepts of OLAP technology, data mining methods, various classification and prediction methods, accuracy and error measures, various methods of cluster analysis, graph mining and mining sequence patterns.

PSO7: Studentswill be able to understand and implement the mathematical modelling of graphical objects required to be drawn/used in different kind of graphical applications. Students learn Remote method invocation for cross-platform data access applications, application related to artificial intelligence using Prolog language, digital image processing techniques.

PSO8: Student will be able to understand finite automata, non-deterministic finite automata, regular set and regular expression, applications of finite automata, regular and context-free grammar, Turing machine, its design and modification, decidability and undecidability of problems.

PSO9: Students will be able to apply software testing knowledge and engineering methods, distinguish characteristics of structural testing methods, design and conduct a software test process for a software testing project, understand and identify various software testing problems and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

Programme Credit Scheme:

M.Sc. with Specialization in Indigenous Knowledge, science and Technology programme is a two-year course divided into four-semesters. The course is of 110 Credits and for the award of degree a student will be required to complete the credits as per the University norm.

Course Credit Scheme

Semester	Core Courses		Specialization focus on Indigenous Knowledge, Science and Technology		Core Elective		*Massive Open Online Courses* (MOOCs) /Open Elective		Skill Enhancement Course		Grand Total Credits
	No. Of Papers	Total Credits	No. Of Papers	Total Credits	No. Of Papers	Total Credits	No. Of Papers	Total Credits	No. Of Papers	Total Credit	

I	3	18	1	4	-	-	-	-	1	2	24
II	3	18	2	8	-	-			1	2	28
III	2	10	2	8	2	8	1	2	1	2	30
IV	2	8	1	4	2	8	1	2			28
Total Credits for the Course	10	54	6	24	4	16	2	4	3	6	110

Selection of Discipline Specific Elective Courses:

The available discipline specific electives are to be selected at the commencement of the III Semester.

1) For a functional area, wherever available a student may opt for Discipline Specific Elective Course in III semester Group comprising of four courses.

2) The discipline specific elective groups in the Semester III and IV will remain the same as the ones selected in Semester III, once a group has been selected, no change in selected groups will be allowed later.

Selection of Open Elective Courses:

1) Options for Open Elective Courses/MOOC will be floated according to availability of faculty and minimum number of students.

2) Open Elective Courses as placed in Semester III and IV would be announced at the beginning of the Semester III and IV, accordingly students will be asked to select that time.

Selection of Value-Added Courses:

Students can choose value added courses as per their interest.

Eligibility for Admissions with No. of Seats:

As per the admission guidelines and brochure of the KISS Deemed to be University.

EXAMINATION AND ASSESSMENT

Scheme of Examinations

Each course in the program tests and evaluate students based on minimum five components viz. Quiz, Assignment and presentation, class participation, midterm exam and End Term Exams to know the students understanding, recalling concepts, analyzing and evaluating, applying in

real life situations and to be creative with new ideas in the concerned subjects.

1. English shall be the medium of instruction and examination.

2. Mid Semester and End Semester Examinations shall be conducted at the end of each Semester as per the Academic Calendar notified by the KISS Deemed to be University and other components during the course to ensure continuous teaching learning process.

3. The system of evaluation shall be as follows:

   3.1 Each paper will carry 100 weightage (marks), of which 50 weightage (marks) shall be reserved for internal assessment based on a combination of tutorials, classroom participation, assignment, seminar, term papers, tests, and attendance. The weightage given to each of these components in a combination shall be decided and announced at the beginning of the semester by the Department in consultation with the faculties.

   3.2 The remaining 50 weightage (marks) in each paper shall be awarded on the basis of a written examination at the end of each semester. The duration of written examination for each paper shall be three hours.

Criteria for weightage (marks) and examination hours for M.Sc. with Specialization in Indigenous Knowledge, Science and Technology

	Weightage	**Time**
➢ Mid-Semester (Internal)	25	1:30hrs
➢ Assignment and Presentation	20	-
➢ Attendance	05	-
➢ End Semester	50	3:00hrs

<u>QUESTION PATTERN</u>

MID SEMESTER

- Five questions of one Weightage each(all questions are compulsory)
- Two question of five Weightage (out of three questions)
- One question of ten Weightage (out of two questions)
- Total 50 Weightage for mid semester examination including Assignment, presentation and attendance

END SEMESTER

- Ten questions of one Weightage each(all questions are compulsory)
- Four questions of five Weightage each(out of six questions)
- Two questions of ten Weightage each(out of four questions)
- Total 50 Weightage for theory portion.

4. Examinations for courses shall be conducted only in the respective odd and even Semesters as per the Scheme of Examinations. Regular as well as ex-students shall be permitted to appear/reappear/improve in courses of Odd Semesters only at the end of Odd Semesters and courses of Even Semesters only at the end of Even Semesters.

5. Use of simple calculator is allowed.

Note: Submission of Record Notebooks for practical examinations

Candidates appearing for practical examinations should submit bonafide Record Notebooks prescribed for practical examinations, otherwise, the candidates shall not be permitted to appear for the practical examinations.

Pass Percentage and Promotion Criteria

a. The minimum weightage required to pass any paper in a semester shall be 40% in each paper and 50% in aggregate of a semester.

   However, a candidate who has secured the minimum weightage to pass in each paper but has not secured the minimum weightage to pass in aggregate may reappear in any of the paper/s of his choice in the concerned semester in order to be able to secure the minimum weightage prescribed to pass the semester in aggregate.

b. A student who has to reappear in a paper prescribed for Semester I/III may do so only in the odd Semester examinations to be held as per academic calendar. A student who has to reappear in a paper prescribed for Semester II/IV may do so only in the even Semester examinations to be held as per academic calendar.

System of Evaluation:

A seven point grading system on a base of 10 shall be followed for grading of the students of Masters of Science in Chemistry with Specialization in Indigenous Knowledge, Science and Technology course operated and governed under semester system. Categorization of these grades and their correlation shall be as below:

Qualification	Grade	Score on 100	Point
Outstanding	“O”	90 to 100	10
Excellent	“E”	80 to 89	9
Very Good	“A”	70 to 79	8

Good	“B”	60 to 69	7
Fair	“C”	50 to 59	6
Below average	“D”	40 to 49	5
Failed	“F”	Below 40	2

Credit Point = CREDIT X POINT for each course item.

CREDIT INDEX (CI) = ∑ CREDIT POINT of all course items in a semester.

Semester Grade Point Average

SGPA = CI / ∑ CREDITS (for a semester)

Cumulative Grade Point Average

CGPA = [∑ CI of all previous semesters up to current semester] / [∑ Credits of all previous semesters up to current semester]

The School will follow the guidelines for examination provide by University from time to time.

Span Period

No student shall be admitted as a candidate for the examination for any of the Parts/Semesters after the lapse of four years from the date of admission to the Semester-I of the M. Sc. with Specialization in Indigenous Knowledge, Science and Technology.

Attendance Requirement

Attendance in Lecturer, tutorials, seminars etc. arranged by the School from time to time, is mandatory according to the Internal Assessment requirement as per University rules.

The marks for attendance shall be as follows		
(i)	For 75%	1 Marks
(ii)	More than 75% but less than 80%	2 Marks
(iii)	80% or more but less than 85%	3 Marks
(iv)	85% or more but less than 90%	4 Marks
(v)	90% and above	5 Marks

Award of Degree:

A Degree certificate under the official seal of the university and signed by the Vice-Chancellor shall be presented at the Convocation or in absentia to each of the successful students of particular degree. The Controller of Examinations shall issue the mark/grade sheet of each semester to the candidates in the sheet of each semester to the candidates in the prescribed format.

Course Structure

The study of science would be incomplete without a comparative study. Hence, to strengthen the study of Indigenous knowledge, Science and Technology, the study of related allied subjects like Physics, Chemistry, Mathematics and Computer science is quite essential. We, at KISS University focus on inter-disciplinary and comparative study of sciences. The syllabus has been designed in such a fashion that the students would study the Indigenous knowledge, Science and Technology vis-à-vis other allied subjects. It will give them a scope to detect the similarities and differences between the Indigenous Technology and Modern Technology to explore the origin of the science and to broaden their employment avenues.

SEMESTER DETAILS: The course comprises of four Semesters.

SEMESTER – I

Paper Code	Paper Name	Weekly Contact			Credits
		L	T	P	
CS- 4001	Data Structures	3	1	0	4
CS- 4003	Operating Systems	3	1	0	4
CS- 4005	Database Management Systems	3	1	0	4
CS- 4007	Mathematical Foundations of Computer Science	1	0	2	2
CS- 4091	Data Structures (Lab)	0	0	4	2
CS- 4093	Operating Systems(Lab)	0	0	4	2
CS- 4095	Database Management Systems (Lab)	0	0	4	2
Specialization: Indigenous Knowledge, Science and Technology					
IK- 4051	Indigenous People and the Science of Cosmology	3	1	0	4
Total Credits24					

SEMESTER – II

Paper Code	Paper Name	Weekly Contact			Credits
		L	T	P	
CS- 4002	Design& Analysis of Algorithms	3	1	0	4
CS- 4004	Web Technology	3	1	0	4
CS- 4006	Theory of Computation	3	1	0	4
CS- 4092	Design& Analysis of Algorithms (Lab)	0	0	4	2
CS- 4094	Web Technology (Lab)	0	0	4	2
CS- 4096	Free &Open-Source Software (Lab)	0	0	4	2
CS-4082	Seminar	0	0	4	2
Specialization: Indigenous Knowledge, Science and Technology					
IK - 4052	Vedic Mathematics	3	1	0	4
IK – 4054	Theme based movies and Museum visit to preserve and promote Tribal Culture through documentation	3	1	0	4
Total Credits		**28**			

SEMESTER – III

Paper Code	Paper Name	Weekly Contact			Credit
		L	T	P	
CS-5001	Software Engineering	3	1	0	4
CS-5003	Data Mining & Data Warehousing	3	1	0	4
CS-5091	Software Engineering (Lab)	0	0	4	2
MO-5021	MOOCs (Choose any course from the following sources) **NPTEL Online Courses** **URL:** https://nptel.ac.in/course.html **Swayam courses** **URL:** https://swayam.gov.in/explorer **MOOC Courses** **URL:** https://www.mooc.org/#course-categories KISS LMS	2	0	0	2
Discipline Specific Elective (Choose any two)					
CS-5031	Computer Graphics	3	1	0	4
CS-5033	Compiler Design	3	1	0	4
CS-5035	Cloud Computing	3	1	0	4
CS-5037	Internet of Things	3	1	0	4
Specialization: Indigenous Knowledge, Science and Technology					
IK- 5051	Indigenous People and the Science of Gemology	3	1	0	4
IK- 5053	Tribal Sports, Nutrition and Health Management	3	1	0	4
IP -5081	Internship	0	0	4	2
Total Credits		**30**			

SEMESTER – IV

Paper Code	Paper Name	Weekly Contact			Credit
		L	T	P	
CS-5002	Artificial Intelligence	3	1	0	4
CS- 5004	Computer Networks & Security	3	1	0	4
CS-5092	Dissertation	0	0	12	6
Discipline Specific Elective(Choose any two)					
CS- 5032	Machine Learning	3	1	0	4
CS- 5034	Computer based Optimization Techniques	3	1	0	4
CS- 5036	Cyber Security	3	1	0	4
CS- 5038	Big Data Analytics	3	1	0	4
Specialization: Indigenous Knowledge, Science and Technology					
IK-5052	Indigenous Knowledge and Intellectual Property Rights	3	1	0	4
Open Elective (Choose any one)					
CS- 5006	Problem Solving Using Python and R	2	0	0	2
CS-5008	Disaster Management	2	0	0	2
Total Credits28					

Grand Total Credits = 110

*** One Credit = 1hour for Theory classes**
*** One Credit = 2 hours for Practical classes**

1st Semester [First Year]

Course Code	Name of the Subject	L	T	P	C
CS- 4001	**Data Structures& Algorithms**	**3**	**1**	**0**	**4**

Prerequisite: Computer basics.

Course Objectives:

1. To design and implement different data structures.
2. To study various searching, sorting techniques and their applications.
3. To compute complexity of algorithms.
4. To be taught algorithm design methodologies

Course Outcomes:

The student should be able to:

CO1. Interpret common data structures and algorithms, andimplement them.

CO2. Appraise among a variety of data structures to design algorithms and solve problems in Scientific computing.

CO3. Analyze algorithmic complexity and choose the best among various data Structures and algorithms for problem solving based on complexity.

UNIT- I **(10 Hours)** Introduction – Arrays – Structures – Stack: Definition and examples, Representing Stacks - Queues and lists: Queue and its Representation, lists – Applications of Stack, Queue and Linked Lists. Binary Trees – Binary Tree Representations – node representation, internal and external nodes, implicit array representation - Operations on binary trees – Binary tree Traversals - Representing Lists as Binary Trees–Search Trees.
UNIT- II **(10 Hours)** Algorithms – Analyzing and Designing algorithms – Asymptotic notations – Recurrences – Methods to solve recurrences – Basic sorting techniques – selection sort, bubble sort, insertion sort and merge sort – Basic Search Techniques – linear search and binary search.
UNIT- III **(10 Hours)** Revisiting various operations of different data structures with time complexity analysis – Design and Analysis of Heap Sort - Quick Sort – Sorting in linear time – Radix sort – Selection in linear time.
UNIT- IV **(10 Hours)** Design Strategies: Recursion - Divide and conquer methodology – Multiplication of large integers – Strassen's matrix multiplication – Greedy method – Prim's algorithm – Kruskal's algorithm – algorithm for Huffman codes – Dynamic Programming – Backtracking and Branch and bound method.
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Books: 1) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest: "Introduction to Algorithms", PHI
References: 1) Seymour Lipschutz: "Theory & Problems of Data Structures", Schaum's Outline Series (McGraw-Hill) 2) Trembley, Sorenson:- An Introduction to Data Structures with Applications. (TMH) 3) Kutty: Data Structures using C++ (PHI) 4) Bhagat Singh, Naps : Introduction to Data Structures (TMH) 5) E Horowitz and S. Sahani, Fundamentals of Computer Algorithm, Universities Press

Subject Code	Name of the Subject	L	T	P	C
CS- 4003	**Operating System**	**3**	**1**	**0**	**4**

Course Objectives:

1. Provide an insight into the basic organization of computer systems.
2. Familiarize students with various components of an Operating System
3. Focus on fundamental problems and optimal solutions for resource management operating systems such as process and disk scheduling and memory management
4. Understand different possible solutions for handling deadlock situation.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Identify the different components of an operating system and analyze techniques for system resource management.

CO2. Compare and evaluate various scheduling algorithms and their performance tradeoffs.

CO3. Relate algorithmic solutions for process synchronization problems and handling deadlocks.

CO4. Analyze performance issues associated with I/O devices.

SYLLABUS

UNIT:1 (10 Hours)

Operating System Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems, Operating System services, user OS Interface, System Calls, Types of System Calls, System Programs, Opening System Design and Implementation, OS Structure, Virtual machines.

UNIT:2 (10 Hours)

Process and CPU Scheduling - Process concepts - The Process, Process State, Process Control Block, Threads, Process Scheduling - Scheduling Queues, Schedulers, Context Switch, Pre-emptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread scheduling, Case studies: Linux, Windows. Process Coordination - Process Synchronization, The Critical section Problem, Peterson's solution, Synchronization Hardware, Semaphores, and Classic Problems of Synchronization, Monitors, Case Studies: Linux, Windows.

UNIT:3 (10 Hours)

Memory Management and Virtual Memory - Logical & physical Address Space, Swapping, Contiguous Allocation, Paging, Structure of Page Table. Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Performance of Demanding Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT:4 (10 Hours)

File System Interface - The Concept of a File, Access methods, Directory Structure, File System Mounting, File Sharing, Protection, File System Implementation - File System Structure, File System Implementation, Allocation methods, Free-space Management, Directory Implementation, Efficiency and Performance. Mass Storage Structure - Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap space Management.

Protection - System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books/References:

1. *Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition, Wiley Student Edition.*
2. *Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson.M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.*
3. *Modern Operating Systems, Andrew S Tanenbaum 3rd Edition PHI.*
4. *Operating Systems A concept - based Approach, 2nd Edition, D. M. Dhamdhere, and*

TMH.
5. *Principles of Operating Systems, B. L. Stuart, Cengage learning, India Edition.*
6. *Operating Systems, A. S. Godbole, 2nd Edition, TMH*
7. *An Introduction to Operating Systems, P.C.P. Bhatt, PHI.*
8. *Operating Systems, S, Haldar and A. A. Arvind, Pearson Education.*
9. *Operating Systems, R. Elmasri, A. G. Carrick and D. Levine, McGraw Hill.*
10. *Operating Systems in depth, T. W. Doeppner, Wiley.*

Subject Code	Name of the Subject	L	T	P	C
CS-4005	**Database Management System**	**3**	**1**	**0**	**4**

Prerequisite: A student should have basic idea on programming and file systems.

Course Objectives

1. Gain a good understanding of the architecture and functioning of Database Management Systems as well as associated tools and techniques.
2. Understand and apply the principles of data modeling using Entity Relationship and develop a good database design.
3. Understand the use of Structured Query Language (SQL) and its syntax
4. Apply Normalization techniques for effective database design.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1.*Identify* and ***classify*** the concepts of Database Management system, Data models and architecture of database, ER to Relational mapping concepts.

CO2.*Apply* the constraints in database using different query languages like: - relational algebra and calculus, SQL and QBE for ***implementing*** the Data definition and data manipulate languages in Database.

CO3.*Compare* the different normal forms to ***Apply*** normalization process to construct consistent Database.

CO4.*Design and Develop* the Database with concurrency control and recovery strategies to make complete Database without confliction and anomalies in concurrent access environment.

SYLLABUS

UNIT:1 (10 Hours)

Introduction to database Systems, advantages of database system over traditional file system, Basic concepts & Definitions, Database users, Database Language, Database System Architecture, Schemas, Sub Schemas, & Instances, database constraints, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models.

UNIT:2 (10 Hours)

Entity relationship model, Components of ER model, Mapping E-R model to Relational schema, Relational Algebra, Tuple & Domain Relational Calculus, Relational Query Languages: SQL and QBE. Database Design:-Database development life cycle (DDLC), Automated design tools, Functional dependency and Decomposition, Join strategies, Dependency Preservation & lossless Design, Normalization, Normal forms:1NF, 2NF,3NF, and BCNF, Multi-valued Dependencies, 4NF & 5NF. Query processing and optimization: Evaluation of Relational Algebra Expressions, Query optimization, Query cost estimation.

UNIT:3 (10 Hours)

Network and Object Oriented Data models, Storage Strategies: Detailed Storage Architecture, Storing Data, Magnetic Disk, RAID, Other Disks, Magnetic Tape, Storage Access, File & Record Organization, File Organizations & Indexes, Order Indices, B+ Tree Index Files, Hashing Data Dictionary.

UNIT:4 **(10 Hours)**

Transaction processing and concurrency control: Transaction concepts, properties of transaction, concurrency control, locking and Timestamp methods for concurrency control schemes. Database Recovery System, Types of Data Base failure & Types of Database Recovery, Recovery techniques, fundamental concepts on Object-Oriented Database, Object relational database, distributed database, Parallel Database, introduction to Data warehousing & Data Mining.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Sudarshan, Korth: Database System Concepts, 6th edition, McGraw-Hill Education*
2. *Elmasari&Navathe: Fundamentals of Database System, Pearson Education.*

Reference Books:

1. *Elmasari&Navathe: Fundamentals of Database System, Pearson Education.*
2. *Ramakrishnan: Database Management Systems, McGraw-Hill Education.*
3. *Andrew S. Tanenbaum: Modern Operating Systems, 3rd Edition, Pearson Education.*
4. *Terry Dawson, Olaf Kirch: Linux Network Administrator's Guide, 3rd Edition O'Reilly*

Subject Code	Name of the Subject	L	T	P	C
CS-4007	**Mathematical Foundations of Computer Science**	**1**	**0**	**2**	**2**

Course Objectives

1. To acquire skills in solving mathematical and logical problems.
2. To comprehend mathematical principles and logic.
3. To understand fundamental concepts and tools in discrete mathematics with emphasis on their applications to computer science

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. To apply the concepts of Discrete Mathematics in the modeling and design of computational problems.

CO2. To design network theory from the concept of Graph theory of Discrete Mathematics.

CO3. Identify and classify the concept of Boolean algebra.

CO4. Apply mathematical logic to solve propositional logic problems.

SYLLABUS

UNIT – 1 Logic

Propositional logic, predicate calculus, Theory of inference, modus pones, resolution, clause system, (CNF, DNF, PDNF, PCNF, NNF), completeness, soundness, network applications, Recurrence Relations, Generating Functions.Fuzzy logic: fuzzy relation, pattern classification, fuzzy analysis, distance between fuzzy sets, area perimeter, height, width of fuzzy subsets.

UNIT-2Combinatorics Graph Theory

Basic concept of graph theory, directed and undirected graph, matrix representation, graph manipulation, Dijkstra algorithm, all pair shortest path problem, Centre of graph, Tree and Text

coding. Counting principle, Pigeon- hole principle, principle of inclusion and exclusion, recurrence relations, Method of proofs.

UNIT-3Boolean Algebra &Latttices

lattices, partial order set, properties of lattices, special lattices, Boolean algebra, Boolean function and simplification, group codes, parity check, single error correcting code.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill.
2. K. H. Rosen, Discrete Mathematics and applications, Tata Mc Graw Hill

Reference Books:

1. *J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.*
2. *R. Grimaldi and B V Ramana, Discrete and combinatorial mathematics: An applied introduction, Pearson education*

Subject Code	Name of the Subject	L	T	P	C
IK- 4051	**Indigenous People and the Science of Cosmology**	**3**	**1**	**0**	**4**

Course Objectives

The course provides an overview of the scientific study of the large-scale properties of the Universe as a whole. It also endeavours to use the scientific method to understand the origin, evolution and fate of the entire Universe.

Course Outcomes:

CO1. Understand the theoretical basis for our modern cosmological view of the universe.

CO2. Apply the knowledge of Modern Physics and Tribal metaphysics and can able to bring tribal concepts to enrich science.

CO3. CO3: Understand the epistemic value and explanatory value of cosmology with a brief history of time: From Big Bang to Black holes.

CO4. CO4: Remember how the universe formed and the stars, planets, black holes, dark matter and galaxies that exist within it.

SYLLABUS

UNIT:1Cosmology: A mythological view

What is cosmology, stellar dynamics and evolution, Galaxy formation and evolution, origin of cosmic rays, General relativity and physical cosmology, string cosmology, Introduction of Mythology, Contemporary approaches to classical and Indian mythology, Significance of river and religion in cosmology, Mythology of prominent rivers of India.

UNIT:2 Cosmology: A Tribal Perspective

Tribal Perspective on Modern Physics and Cosmology: Classical reality and philosophy, Classical Physics, Understanding Indigenous Science and Indigenous Knowledge: Cataloging Indigenous Knowledge, Knowledge on Modern Physics and Tribal metaphysics. Cosmology and Indigenous World. Allowing Tribal concepts to enrich science.

UNIT:3

Cosmology: A Scientific View

Fundamental Observation: Cosmology a history of Universe, Epistemic value of cosmology, Explanatory value of Cosmology, A brief history of time: From Big Bang to Black holes. Newton verses Einstein;The way of Newton, The special way of Einstein, The general way of Einstein. Describing Curvature. The Robertson-Walker Metric, Proper distance.

UNIT:4

Astronomy and Astrophysics

Solar System: The Sun, Solar Eclipses, Planets, Natural Satellites in Solar System, Selected Comets, Selected Asteroids. Star: 50 visually brightest stars, Pulsars, Galaxies, Properties of Milky way Galaxy.

The Universe: Mass-radius-density data for Astronomical object, Radio Astronomy, Microwave background, selected discrete radio Sources, Radio spectra. IR Astronomy, Planetary Nebula, Emission from Galaxies.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Suggested Readings:

1. A brief History of Time by Stephen Hawking
2. Cosmos by Carl Sagan
3. The Elegant Universe by Brian Greene
4. Gravitation and Cosmology by S Weinberg
5. Introduction to Cosmology by J.V Narlikar
6. An Introduction to Mathematical Cosmology by J.N Islam
7. Cosmological Physics by J.A Peacock
8. Modern Cosmology by Dodelson
9. Introduction to Cosmology by Barbara Ryden
10. An introduction to Modern Cosmology by J.N Islam and Andrew Liddle

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4091	**Data Structures Lab**	**0**	**0**	**4**	**2**

Course Objectives

1. To formulate algorithm, translate into program and then execute the programs for verifying its correctness.
2. To analyze a problem for knowing its efficiency and decompose it into functions using divide and conquer approach.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Develop programming skills which require for solving given problems.
CO2. Using linear and nonlinear data structures to solve real-time problems.
CO3. Use searching and sorting techniques to different application domains.
CO4. Implement different design strategies to solve complex problems.

LIST OF EXPERIMENTS

1. Programs using one-dimensional, two-dimensional arrays.
2. Implementation of Stack, Queue operations.
3. Implementation of operations on singly, doubly, circular linked lists.
4. Implementation of operations on binary tree.
5. Implementation of binary tree traversal.
6. Implementation of basic sorting techniques (selection sort, bubble sort, Insertion sort and merge sort).
7. Implementation of sorting techniques like heap, quick and radix sort.
8. Implementation of searching algorithms.
9. Implementation of Strassen's matrix multiplication.
10. Implementation of Greedy method.
11. 10. Implementation of Prim's and Kruskal's algorithm.

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4093	**Operating System Lab**	**0**	**0**	**4**	**2**

Course Objectives

1. Provide an insight into the basic organization of computer systems.
2. Familiarize students with various components of a Linux Operating System

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Work on the concepts, design, and structure of the Linux operating system.
CO2. Use basic Linux Utilities on Linux program.
CO3. Work on Linux shell programming to automate the code compiling process.

LIST OF EXPERIMENTS

1. Usage of following commands:ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
2. Usage of following commands:
3. cal, cat(append), cat(concatenate), mv, cp, man, date.
4. Usage of following commands:
5. chmod, grep, tput (clear, highlight), bc.
1. Write a shell script to check if the number entered at the command line is prime or not.
2. Write a shell script to modify “cal” command to display calendars of the specified months.
3. Write a shell script to modify “cal” command to display calendars of the specified range of months.
4. Write a shell script to accept a login name. If not a valid login name display message – “Entered login name is invalid”.
5. Write a shell script to display date in the mm/dd/yy format.
6. Write a shell script to display on the screen sorted output of “who” command along with the total number of users .
7. Write a shell script to display the multiplication table any number,
8. Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.
9. Write a shell script to find the sum of digits of a given number.
10. Write a shell script to merge the contents of three files, sort the contents and then display them page by page.
11. Write a shell script to find the LCD(least common divisor) of two numbers.
12. Write a shell script to perform the tasks of basic calculator.
13. Write a shell script to find the power of a given number.
14. Write a shell script to find the factorial of a given number.
15. Write a shell script to check whether the number is Armstrong or not.
16. Write a shell script to check whether the file have all the permissions or not.
20. Program to show the pyramid of special character “*”.

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4095	**Database Management Systems Lab**	**0**	**0**	**4**	**2**

CourseObjectives

1. To implement the Data Mining Algorithms
2. To analyze various datasets

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Work with ETL tools.

CO2. Use the basics of SQL and construct queries using SQL in database creation.

CO3. Analyze and Select storage and recovery techniques of database system.

CO4. Design and implement properly structured databases.

LIST OF EXPERIMENTS

Exercises to construct and query databases.

2nd Semester [First Year]

Course Code	Name of the Subject	L	T	P	C
CS- 4002	**Design & Analysis of Algorithms**	**3**	**1**	**0**	**4**

Prerequisite: Computer basics.

Course Objectives:

1. To formulate algorithm, translate into program and then execute the programs for verifying its correctness.
2. To analyze a problem for knowing its efficiency and decompose it into functions using divide and conquer approach.

Course Outcomes:

Student should be able to:

CO1. Construct simple algorithms for arithmetic and logical problems and translate into programs.
CO2. Interpret and develop programs using loop, arrays and analyze its complexity.
CO3. Summarize and develop programs using strings, functions and recursions.
CO4. Develop programs using pointers and structures and understand their functionality.
CO5. Analyze different sorting algorithm based on time and space complexity.

UNIT- I **(10 Hours)**

Introduction: Definition, Characteristics of algorithm, Growth of Functions, Asymptotic analysis, Amortized analysis, standard notations and common functions, limit theorem, String's formula. Recurrences: solution of recurrences by substitution, recursion tree and Master methods, Extension Master Methods. Algorithm design techniques.

UNIT- II **(10 Hours)**

Divide-and- conquer Approach: Binary search, Quick sort, Merge sort, Heap Sort, Priority Queue, Lower bounds for sorting. Worst case analysis of Quick sort.

Dynamic programming methodology: Elements of dynamic programming, Matrix-chain multiplication, Longest common subsequence, Assembly-line scheduling.

Greedy Algorithms: Elements of Greedy strategy, Activity selection Problem, Fractional knapsack problem, Huffman codes.

UNIT- III **(10 Hours)**

Graph Algorithms: Data structure for disjoint sets, Disjoint set operations, Linked list representation, path compression, Disjoint set forests. Graph Algorithms and their characteristics, Breadth first search and depth-first search, Minimum Spanning Trees, Kruskal algorithm and Prim's algorithms, single- source shortest paths (Bellman-ford Algorithm and Dijkstra's algorithms), All-pairs shortest paths (Floyd–Warshall Algorithm).

UNIT- IV **(10 Hours)**

Back tracking, Branch and Bound, Eight Queen problem, Sub Set Sum Problem. String matching algorithms, naïve string-matching algorithm, Rabin-Karp algorithm, Knuth–Morris–Pratt algorithm, NP - Completeness (Polynomial time, Polynomial time verification, NP - Completeness and reducibility, NP-Complete problems (without Proofs), Approximation algorithms characteristics, Traveling Salesman Problem, vertex Cover Problem.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest: “Introduction to Algorithms”, PHI

References:

1) Seymour Lipschutz: “Theory & Problems of Data Structures”, Schaum’s Outline Series

(McGraw-Hill)
2) Trembley, Sorenson:- An Introduction to Data Structures with Applications. (TMH)
3) Kutty: Data Structures using C++ (PHI)
4) Bhagat Singh, Naps : Introduction to Data Structures (TMH)
5) E Horowitz and S. Sahani, Fundamentals of Computer Algorithm, Universities Press

Subject Code	Name of the Subject	L	T	P	C
CS-4004	**Web Technology**	**3**	**1**	**0**	**4**

Course Objectives

1. To comprehend basics of the internet and web terminologies.
2. To introduce scripting language concepts for developing client-side applications.
3. To practice server-side programming features – PHP, JSP.
4. To be familiar with database applications
5. To know the usefulness of web services.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Design and develop web applications.
CO2. Explain client and server-side scripting and their applicability.
CO3. Write scripts using JavaScript in a web page.
CO4. Effectively incorporate JavaScript in a web page
CO5. Design forms and check for data accuracy

SYLLABUS

UNIT I **[08 Hours]**

Internet and World Wide Web: Introduction to Internet, www, Internet browsers Netscape & Explorer, Introduction to Client Server Architecture/Computing, History of the web, Growth of the web, Protocols governing the web, resources of Internet, H/W & S/W requirements of Internet, Internet service providers, Internet Services, Internet Clients, and Internet Servers.

UNIT II **[10 Hours]**

Markup Languages: Introduction to HTML, Formatting Tags, Links, Lists, Tables, Frames, Forms, Comments in HTML, DHTML and XML Documents, Data Interchange with an XML document, Document type definition, Features and Applications, Working with Style sheets. Client Side Scripting: Scripting basics, Introducing JavaScript, Documents, Statements, Functions, Objects in JavaScript, Events and Event handling, Arrays, Forms, Buttons, Checkboxes, Text Fields and Text Area

UNIT 3 **[10 Hours]**

Server Side Scripting: Introduction to server side scripting language, RMI, The Problem with Servelet. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat- Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging - Sharing Data Between JSP pages, Requests and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

UNIT 4 **[10 Hours]**

PHP Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. *"Learning PHP, MySQL, JavaScript, CSS & HTML5", Robin Nixon, O'Reilly, 3rd Edition, 2014.*
3. *"Programming The World Wide Web", Robert W. Sebesta, Pearson, 7th Edition, 2013.*
4. *"HTML5 Up and Running", Mark Pilgrim, O'Reilly, 1st Edition, 2012.*

Subject Code	Name of the Subject	L	T	P	C
CS-4006	**Theory of Computation**	**3**	**1**	**0**	**4**

Course Objectives

1. To familiarize students to construct regular expressions, regular grammars & to identify non - regular languages
2. Teach students to identify context - free languages, to convert the given grammar to various normal forms, & to make use of membership algorithm.
3. Teach students to construct Push - Down Automata which represent context - free languages, closure properties, & to identify non - context - free languages.
4. To familiarize students to Recursively Enumerable languages, Recursive languages, construction of Turing Machines, PCP, & undecidable problems.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Explain the basic concepts of formal computation and its relationship to language.
CO2. Design a computational model using Turing machine for the given problem.
CO3. Design Finite Automata machines for given problems.
CO4. Analyze complexity of various problem solving techniques using PDA and TM with recursion.
CO5. Generate the strings/sentences of a given context-free languages using its grammar.

SYLLABUS

UNIT:1 **(10 Hours)**

Mathematical preliminaries: Alphabet, String, Languages, Grammars, Strings and operations on strings.

Finite Automata: Definition, Basic model, Types of Finite Automata, Design of DFA, Design of NFA, NFA vs. DFA, Eliminating **ε**-transitions from NFA, NFA to DFA conversion, NFA or DFA as a language acceptor, Minimization of Finite Automata. Equivalence of two Finite Automata

UNIT:2 **(10 Hours)**

Regular Expressions: Regular Set and Regular Expressions. Operators in Regular expressions, Building Finite Automata from Regular expression, Arden's theorem & Building Regular expression from Finite Automata, Pumping Lemma for Regular languages, Closure properties of Regular languages.

Grammar: Definition, Regular Grammar, Regular Grammar to Finite Automaton, Finite Automaton to Regular Grammar, Designing Context Free Grammar, String Derivation, Parse Tree Construction, Ambiguous Grammar, Chomsky and Greibach Normal Forms, CYK parsing algorithm,Closure
Properties of CFL, Pumping Lemma for CFL, Introducing Non-Context Free Grammar, Chomsky Hierarchy.

UNIT:3 **(10 Hours)**

Push Down Automata: Basic Model, Components, Moves of a PDA, ID of a PDA, Design of Deterministic PDA and Non-deterministic PDA, PDA to CFG and CGA to PDA conversion.

Turing Machines: Basic Model, Components, move of a TM, ID of TM, Design of a TM, Variants Of Turing Machine, Recursively Enumerable Languages, Undecidable problems, Post correspondence problem as an Undecidable Problem. Linear Bounded Automata and Context Sensitive Languages

UNIT:4 **(10 Hours)**

Primitive Recursive functions: μ- Recursive functions, Cantor and Godel numbering, ckermann's function, Excursiveness of Ackermann and Turing computable functions. Church Turing hypothesis, Recursive and Recursively Enumerable sets, NP Completeness: P and NP, NP complete and NP Hard problems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Introduction to the theory of computation, Michael Sipser, Cengage Learning.

Formal Language and Automata Theory, C. K. Nagpal, Oxford University Press.

Reference Books*:*

2. Theory of Computer Science : Automata, Languages And Computation by by*K L P Mishra* and N Chandrasekaran
3. Introduction to Automata Theory, Languages and Computation: J. E. Hopcroft, J.D Ullman, Pearson Education.

Subject Code	Name of the Subject	L	T	P	C
IK - 4052	**Vedic Mathematics**	**3**	**1**	**0**	**4**

Course Objectives

The course reduces long mental calculations and it improves speed and accuracy. And students can solve board exams using Vedic tricks and formulas where it saves time in long mathematical calculations. It also improves the spiritual side of the student's personality and increase creativity and confidence.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Correlate the modern mathematics in Vedas, different sutras and sub sutras.

CO2. Recognizing the basic Concepts of Ancient Arithmetic, development and their uses.

CO3. Implement the techniques of simple equations, quadratic equations, cubic equations, biquadrate equation, simultaneous equation in mathematics.

CO4. Apply Vedic sutras in factorization, H.C.F, partial fractions, differential calculus in mathematics.

CO5. Analyse the mathematical Concept in Tribal Tradition: Ethno mathematics: development and meaning of "ethno mathematics", Numerals and naming systems, Mathematics in folk art, Informal mathematics.
SYLLABUS
UNIT:1 Introduction to Mathematics in Vedas, different sutras and sub sutras, examples of sutras and sub sutras. Basic Concepts of Ancient Arithmetic, development and their uses. Different operations in Vedic mathematics: Addition, subtraction, multiplication, division, square, square root, cube and cube root and Examples.
UNIT:2 Knowledge on Arithmetic progression in Ancient India and different techniques. Simple equations, quadratic equations, Cubic equation, biquadrate equation, simultaneous equation in Vedic mathematics.
UNIT:3 Mathematical numbers in Indian Tradition and different types of problems relating to Vedic sutras. Factorization, H.C.F, Partial fractions, differential calculus in Vedic mathematics.
UNIT:4 Mathematical Concept in Tribal Tradition: Ethno mathematics: development and meaning of "ethno mathematics", Numerals and naming systems, Mathematics in folk art, Informal mathematics. Pythagoras theorem, integration by partial fractions, Apollonius theorem, Analytical geometry in Vedic mathematics
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Book: **Reference:** Vedic Mathematics space book by S,.JK. Cosmic Kapoor- 2005 Vedic Arithmetic and Development of basic concepts Dr. K.P. Chamola – 2006 Arithmetic

Subject Code	Name of the Subject	L	T	P	C
IK - 4054	**Theme based movies and Museum visit to preserve and promote Tribal Culture through documentation**	**3**	**1**	**0**	**4**

Course Objectives

To preserve and promote Tribal Culture through documentation.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Experiential learning
CO2. Document their culture
CO3. Preserve their culture
CO4. Promote their culture

SYLLABUS

Theme based movies and Museum visit to preserve and promote Tribal Culture through documentation

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4092	**Design and Analysis of Algorithms Lab**	**0**	**0**	**4**	**2**

CourseObjectives

3. To formulate algorithm, translate into program and then execute the programs for verifying its correctness.
4. To analyze a problem for knowing its efficiency and decompose it into functions using divide and conquer approach.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Write programs for solving any problems.
CO2. Implement linear and nonlinear data structures to solve real-time problems.
CO3. Compute searching and sorting techniques to different application domains.
CO4. Use different design strategies to solve complex problems.
CO5. Analyze the different sorting algorithm based on time and space complexity.

LIST OF EXPERIMENTS

1. Implement Insertion Sort (The program should report the number of comparisons)
2. Implement Merge Sort(The program should report the number of comparisons)
3. Implement Heap Sort (The program should report the number of comparisons)
4. Implement Randomized Quick sort (The program should report the number of comparisons)
5. Implement Radix Sort.
6. Implement Searching Techniques
7. Implementation of Recursive function.
8. Array and Linked list implementation of Stack and Queue.
9. Implementation of Single, Double and circular Linked List
10. Creation and traversal of Binary Search Tree.

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4094	**Web Technology Lab**	**0**	**0**	**4**	**2**

CourseObjectives

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Use web design tools and to design and develop webpagesprofessionally.
CO2. Explain client and server-side scripting and their applicability.
CO3. Write scripts using JavaScript in a web page.
CO4. Effectively incorporate JavaScript in a web page
CO5. Design forms and check for data accuracy

LIST OF EXPERIMENTS

Exercises to create Web Applications with HTML5 & CSS for frontend and PHP & JSP as backend.

Subject Code	Name of the Laboratory	L	T	P	C
CS- 4096	**Free & Open-Source Software (Lab)**	**0**	**0**	**4**	**2**

CourseObjectives

1. To familiarize the usage of Free &Open-SourceSoftware

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Explain students to FOSS environment and introduce them to use and modify Existing programs using open-source packages/Technologies.

CO2. Explain the installation of various packages in open source operating systems.

CO3. Interpret various version control systems.

CO4. Explain the kernel configuration and virtual environment.

LIST OF FOSS

1. Android/ Mozilla OS
2. GIMP: GNU Image Manipulation Program
3. Apache Struts
4. PHP
5. Python
6. Ruby
7. Apache Cassandra database
8. Mongo DB, NoSQL
9. Hadoop

3rd Semester [Second Year]

Subject Code	Name of the Subject	L	T	P	C
CS- 5001	**Software Engineering**	**3**	**1**	**0**	**4**

Course Objectives

1. Understand the phases in a Software project
2. Understand fundamental concepts of requirement engineering & analysis model
3. Understand the major considerations for enterprise integration and deployment.
4. Learn various testing and maintenance measures

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. To learn various software development process models and their suitability

CO2. Understanding Evolution of Software Engineering and different life cycle models.

CO3. Generate Conventional Software Management and Evolution of Software Economics.

CO4. Explain how a software process flows and understand Project Organizations and Responsibilities.

CO5. Explain Methods and strategies of Software design, coding and testing.

SYLLABUS

UNIT:1 **(10 Hours)**

Software Process Models:

Software Product, Software crisis, Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping mode, evolutionary model, spiral model, RAD model, Agile models.

Software Requirements Engineering:

Requirement Gathering and Analysis, Functional and Non-functional requirements, Software Requirement Specification (SRS), IEEE 830 guidelines, Decision tables and trees.

UNIT:2 **(10 Hours)**

Structured Design & Testing:

Overview of design process: High-level and detailed design, Cohesion and coupling, Modularity and layering, Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure Chart, Basic concepts of Object Oriented Analysis & Design. Testing: - Unit testing, Black-box Testing, White-box testing, Cyclomatic complexity measure, coverage analysis, mutation testing, Debugging techniques, Integration testing, System testing, Regression testing.

UNIT:3 **(10 Hours)**

Conventional Software Management:

Evolution of Software Economics: Software Economics, pragmatic software cost estimation. Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.

UNIT:4 **(12 Hours)**

Flows of the process: Software process workflows, Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Interactive Process Planning: Work

breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning.Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. *Fundamentals of Software Engineering, Rajib Mall, PHI, 2014.*

2. *Walker Rayce : Software Project Management, Pearson Education, 2005*

Reference Book

1. *Software Engineering, A Practitioner's Approach, Roger S. Pressman, TMG Hill.*
2. *Software Engineering, I. Sommerville, 9th Ed. , Pearson Education*
3. *Richard H.Thayer: Software Engineering Project Management, IEEE Computer Society, 1997*
4. *ShereK.D. : Software Engineering and Management, Prentice Hall, 1988*

Subject Code	Name of the Subject	L	T	P	C
CS- 5003	**Data Mining & Data Warehousing**	**3**	**1**	**0**	**4**

Course Objectives

1. To understand the data warehouse and mining them to extract knowledge.
2. To interpret the concepts of Association Rule Mining, Classification and Clustering applying various algorithms to different datasets.
3. To understand the data warehouse and data mining to extract knowledge.
4. To understand the concepts of Association Rule Mining, Classification and Clustering applying various algorithms to different datasets.

Course Outcomes:

CO1. Evaluate raw data to make it suitable for various data mining algorithms.

CO2. To design Multidimensional Data Model, Data Warehouse Architecture, Efficient Methods for Data Cube Computation.

CO3. Identify and apply Data mining techniques to solve real world problems.

CO4. Analyze data mining and warehousing projects in business environment.

SYLLABUS

UNIT:1 **(10 Hours)**

Overview: Data warehousing, The compelling need for data warehousing, the Building blocks of data warehouse, data warehouses and data marts, overview of the components, metadata in the data warehouse, trends In data warehousing, emergence of standards, OLAP Vs OLTP, data cube, multidimensional data warehouse.

UNIT:2 **(10 Hours)**

Introduction to Data mining, Data mining Functionalities, Data pre-processing (data summarization, data cleaning, data integration and transformation, data reduction, data discretization), Mining frequent patterns, associations, correlations (market basket analysis, the a-priori algorithm, mining various kinds of association rules, from association mining to correlation analysis).

UNIT:3 **(10 Hours)**

Classification: classification by decision tree induction, Rule based classification, classification by neural networks, and classification by genetic algorithm. Cluster Analysis: types of data in cluster analysis, A categorization of major clustering methods (partitioning methods, hierarchical methods), clustering high dimensional data, outlier analysis Advanced techniques: web mining,

spatial mining, temporal mining.

UNIT:4 **(10 Hours)**

Introduction to the data warehouse project, Data warehousing implementation, Web enabled data warehouse, Data mining applications in (financial data Analysis, retail industry, telecommunication industry, Biological data analysis, intrusion detection, in other scientific applications), and Data warehouse project.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Experts

Text Books:

1. *Data Mining: Concepts and techniques: J.Han and M.Camber, Elsevier.*
2. *Data warehousing Fundamentals: Paulraj Ponniah, Willey India.*

Ref. Books

1. *Data Mining –A Tutorial based primer by R.J.Roiger, M.W.Geatz, Pearson Education.*
2. *Data Mining & Data Warehousing Using OLAP: Berson, TMH.*
3. *Data Warehousing: Reema Thareja, Oxford University Press.*

Subject Code	Subject Code	L	T	P	C
CS-5031	**Computer Graphics**	**3**	**1**	**0**	**4**

Course Objectives

1. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
2. Introduce the use of geometric transformations on graphics objects and their application in composite form.
3. Impart frame extraction with different clipping algorithms and transformation to a graphics display device.
4. Introduce projections and visible surface detection techniques for display of 3D scene on 2D screen and rendering of projected objects to naturalize the scene in 2D view.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Toexplain the structure of modern computer graphics systems and ***implement*** its primitives.

CO2. Understand the applications of computer graphics, display devices and operating principle. .

CO3. Apply Graphics in greater depth to more complex courses like Image Processing, Virtual, Augmented Reality, etc.

CO4. To ***visualize*** surface detection and Virtual reality for a better visual effect.

SYLLABUS

UNIT:1 **(10 Hours)**

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices, monitor and work station. Graphics output Primitives: point and line, drawing Algorithms: DDA and Bresenham's, Circle drawing Algorithms: Midpoint Circle and Bresenham's filled area primitives.

UNIT:2 **(10 Hours)**

Two Dimensional Geometric Transformations: Translation, rotation, Scaling, Reflection, Shear, Matrix Representation, Composite Transformations, Transformation between coordinate systems. Window-to- View port Coordinate Transformation. Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland Hodgeman Algorithm).

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation. Projections: Parallel Projection and Perspective

Projection.

UNIT:3 **(10 Hours)**

Object representation: Spline Representation, Bezier Curves and B-Spline Curves. Fractal Geometry: Fractal Classification and Fractal Dimension. Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm

UNIT:4 **(10 Hours)**

Light pattern and Illumination Models: Aliasing and Anti aliasing, Half toning, Thresholding and Dithering, Basic Models, Displaying Light Intensities. Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.

Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing. Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices

Teaching Methods: Chalk& Board/ PPT

Text Books:

1. *Computer Graphics with Virtual Reality System, Rajesh K.Maurya, WileyDreamtech.*
2. *Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education*

Reference Book:

1. *Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley*
2. *Procedural Elements of Computer Graphics- David Rogers (TMH)*
3. *Computer Graphics: Algorithms and Implementations – D.P Mukherjee & Debasish Jana (PHI)*
4. *Introduction to Computer Graphics & Multimedia – Anirban Mukhopadhyay*

Subject Code	Name of the Subject	L	T	P	C
CS- 5033	**Compiler Design**	**3**	**1**	**0**	**4**

CourseObjectives

1. To introduce the major concept areas of language translation and compiler design.
2. To enrich the knowledge in various phases of compiler and its use.
3. To provide practical programming skills necessary for constructing a compiler

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Understand and describe compiler and its features.
CO2. Use the knowledge of patterns, tokens and lex for parsing of strings.
CO3. To optimize the performance of a program in terms of speed and space.
CO4. Use different powerful compiler generation tools and derive the machine dependent code.

SYLLABUS

UNIT:1 **(10 Hours)**

Introduction: Overview and phases of compilation. Lexical Analysis: Non-deterministic and deterministic finite automata (NFA & DFA), regular grammar, design of a lexical analyzer, lexical analyzer generator. Lex and flex Syntax Analysis:Role of a parser, context free grammars and context free languages, parse trees and derivations, ambiguous grammar. Top Down Parsing: Recursive descent parsing, LL(1) grammars, non-recursive predictive parsing, error reporting and recovery.

UNIT:2 **(10 Hours)**

Bottom Up Parsing: Handle pruning and shift reduces parsing, SLR parsers and construction or SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, parsing using ambiguous grammars, error reporting and recovery, parser generator. Syntax Directed Translation**:** Syntax directed definitions (SDD), inherited and synthesized attributes, dependency graphs, evaluation orders for SDD, semantic rules,

application of syntax directed translation.

UNIT:3 **(10 Hours)**

Symbol Table: Structure and features of symbol tables, symbol attributes and scopes. Intermediate Code Generation: DAG for expressions, three address codes - quadruples and triples, types and declarations, translation of expressions, array references, type checking and conversions, translation of Boolean expressions and control flow statements, back patching, intermediate code generation for procedures. Run Time Environment: storage organizations, static and dynamic storage allocations, stack allocation, handlings of activation records for calling sequences.

UNIT:4 **(10 Hours)**

Code Generations: Factors involved, registers allocation, simple code generation using stack allocation, basic blocks and flow graphs, simple code generation using flow graphs .Elements of Code Optimization: Objective, peephole optimization, concepts of elimination of local common sub-expressions, redundant and un-reachable codes, basics of flow of control optimization.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. *Compilers – Principles, Techniques and Tools Authors: Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman Publisher: Pearson*

Reference Books:

1. *Morden Compiler Design, D. Galles, Pearson Education.*
2. *Compiler Design in C, Allen I. Holub, PHI*

Subject Code	Subject Code	L	T	P	C
CS-5035	**Cloud Computing**	**3**	**1**	**0**	**4**

Course Objectives

1. Understand the rationale behind the cloud computing revolution
2. Introduce various models of cloud computing
3. Understand how to design applications on cloud and the role of security
4. Understand and design distributed systems for scalability

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Explain the technical and business rationale behind cloud computing.
CO2. Outline the model of cloud computing to use for solving a particular problem.
CO3. Design and Build applications for the cloud and understand the security implications.
CO4. Understand and Apply the fundamentals of distributed systems design to cloud computing.

SYLLABUS

UNIT:1 **(10 Hours)**

Cloud Computing: Introduction, Types of cloud: private, public and hybrid cloud, . Hardware and Infrastructure: IaaS, PaaS, SaaS. public vs private clouds, Benefits and challenges of cloud computing, Virtualization: Types of Virtualization, Implementation Levels, Virtualization Structures , Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices ,Virtual Clusters and Resource management – Virtualization for Data-center Automation. role of virtualization in enabling the cloud,

UNIT:2 **(10 Hours)**

Cloud infrastructure: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Cloud Applications: Technologies and the processes required when deploying web services; Deploying

a web service from inside and outside a cloud architecture, advantages and disadvantages Benefits and challenges to Cloud architecture, Application availability, performance, security and disaster recovery; next generation Cloud Applications.

UNIT:3 **(10 Hours)**

Cloud service management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g. Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)

UNIT:4 **(10 Hours)**

Cloud security: Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control, Autonomic Security. Cloud based service, applications and development platform

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Cloud Computing : A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, 2010 by The McGraw-Hill*
2. *Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355],2010*
3. *Rajkumar Buyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", TMGH, 2013.*

Subject Code	Name of the Subject	L	T	P	C
CS-5037	**Internet of Things**	**3**	**1**	**0**	**4**

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Understand internet of Things and its hardware and software components.

CO2. Interface I/O devices, sensors & communication modules.

CO3. Remotely monitor data and control devices.

CO4. Use the IoT technologies in practical domains of society to develop real life IoTbased projects.

SYLLABUS

UNIT:1 **(8 Hours)**

Introduction to IoT: - Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

Domain-Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health &Life Style.

UNIT:2 **(9 Hours)**

Elements of IoT: - Hardware Components- Computing (Arduino, Raspberry Pi), Communication,

Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for CommunicationProtocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

UNIT:3 **(18 Hours)**

IoT Application Development: - Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT:4 **(10 Hours)**

IoT Case Studies: - IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *VijayMadisetti, ArshdeepBahga," Internet of ThingsA Hands- On-Approach",2014,ISBN:978 0996025515.*
2. *Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs.*
3. *Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.*
4. *Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi.*

Reference Books:

1. *AdrianMcEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0 .*
2. *Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN: 0989973700.*
3. *Adrian McEwen, "Designing the Internet of Things", Wiley.*
4. *Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill.*
5. *Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.*

e-Books:

1. *Designing for the Internet of Things, O'Reilly, February 2015.*
2. *Getting Started with the Internet of Things, O'Reilly 4th edition, October, 2015.*

Subject Code	Name of the Subject	L	T	P	C
IK-5051	**Indigenous People and the Science of Gemology**	**3**	**1**	**0**	**4**

Course Objectives

The main objective of this course is to look at the course in a more general way, then Gemology mainly involves topics related to the identification of gems, physical and chemical properties of gems, differentiating gems on the various basis, grading and assorting gems, processing them, and designing them for accessories etc.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Acquire skills in gems mineralogy and genesis.

CO2. Acquire skills to identify and characterize different gemstones by means of physical and optical techniques.

CO3. Remember the physical and optical properties of gemstones and can apply their knowledge for grading and engraving.

CO4. Explain the science behind different colours of gemstones and their healing effects.

SYLLABUS

Unit-I: Introduction to the world of Gemstones

Ancient history of Gem stones, Mythology related to Gem stones, Use of Gems among indigenous people, Crystallography, study on crystal growth, formation of atomic lattice, origin and structure of gem stones, twinned crystal, Rough gemstone identification, knowledge of identification process

UNIT:2Properties of Gemstones

Physical and optical properties of gemstones, grading parameters of gemstones, various shapes and cutting of gemstones, Engraving on stones, drilled stones, Interlink of beauty, rarity, durability and its effect on valuation, Internal and external factors that affects valuation

UNIT:3Colour and Healing Power

The healing power of Gem stones, Tribal concept on Gemstones, Scientific approach of gemstones, Top gemstones with their colours and healing qualities, Science behind different colours of gemstones and their healing effects, precious gemstones found in tribal areas. Tribal ornaments having gemstones, semi precious stones and their practical identification, organic gemstones, ornament making techniques in both traditional and modern, Ornament design, stones used in fine and fashion jewelers, rare stones collection.

UNIT:4Terminology and nomenclature

Terminology and nomenclature of gemstones as per Indian and International markets, weights used in the gem trade, Market system of gems buying and selling, Gems and human race, Career and jobs, Scope in Gemology, Gemology as a tool for tribal development.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Colour encyclopedia of Gemstones by Joel. E. Arem
2. The Gemsstones Handbook by Arthur Thomas
3. Precious Stones, Vol-I & II: Max Bauer
4. Gemstones of the World: Walter Schumann
5. Gemology: Cornelius S. Hurlbut & Robert C Kammerling
6. Popular Gemology: Richard M Pearl
7. Dictionary of Gems and Gemology: Robert M Shiplley
8. Gemmolog: Peter G Read
9. Gem: Smiths Onian
10. Stoned:Jewellery,obsession: Aja Raden
11. Rocks,Minerals and Gems: John Farndon

Subject Code	Name of the Subject	L	T	P	C
IK-5053	**Tribal Sports, Nutrition and Weight Management**	**3**	**1**	**0**	**4**

Course Objectives

The main objective of this course is to learn about energy expenditure during exercise, the use of supplements, the proper dietary needs for training and basic nutritional concepts. Individuals gain an understanding of exercise physiology and learn how to create a nutritional fitness plan for each sport.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Examine the role of nutrition in sports and health management.

CO2. Evaluate and utilize the role of carbohydrates, fat and protein in sports.
CO3. Create a culture that embraces professionalism, ethics and change, and inspires innovation, productivity and teamwork.
CO4. Evaluate and utilize the key components of the health care system and health system globally to deliver excellent integrative health services.
CO5. Develop appropriate professional behaviours and leadership skills for careers in health care.

SYLLABUS

UNIT:1

Introduction to Sports Nutrition: Meaning and Definition of Sports Nutrition o Basic Nutrition guidelines Role of nutrition in sports, Factor to consider for developing nutrition plan

UNIT:2

Nutrients: Ingestion to energy metabolism: Carbohydrates, Protein, Fat – Meaning, classification and its function, Role of carbohydrates, Fat and protein during exercise

Vitamins and Nutrition: Vitamins, Minerals, Water – Meaning, classification and its function Role of hydration during exercise, water balance
Nutrition – daily caloric requirement and expenditure.

UNIT:3

Nutrition and Weight Management: Meaning of weight management Concept of weight management in modern era Factor affecting weight management and values of weight management, Concept of BMI (Body mass index), Obesity and its hazard, Myth of Spot reduction, Dieting versus exercise for weight control, Common Myths about Weight Loss, Obesity – Definition, meaning and types of obesity,
Health Risks Associated with Obesity, Obesity - Causes and Solutions for Overcoming Obesity.

UNIT:4

Steps of planning of Weight Management: Nutrition – Daily calorie intake and expenditure, Determination of desirable body weight Balanced diet for Tribal Children, Maintaining a Healthy Lifestyle, Weight management program for sporty child, Role of diet and exercise in weight management, Design diet plan and exercise schedule for weight gain and loss

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. "Environmental Engineering" by Peavy, H. S., Rowe, D. R., Tchobanoglous, G.McGraw Hills, New York, 2013.
2. "Physicochemical processes for water quality control" by Weber, W.J. John Wileyand sons, Newyork, 2003.

Subject Code	Name of the Subject	L	T	P	C
CS- 5081	**Internship**	**0**	**0**	**4**	**2**

CourseObjectives

To enable students to acquire practical knowledge and to act professionally in this area. This is meant to provide a scope to the students to apply theoretical knowledge in the real world, explore further in-depth knowledge in Indigenous Knowledge, Science and Technology.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. The students will have working knowledge in the real world and operate.

CO2. Develop an understanding of the importance and scope of industry interface.

CO3. Understand the changing micro and macro environment of organizations and importance of industry research and forecasting.

CO4. Develop an understanding of the competitive strategies for industry.

CO5. Establish a link between academic programme and industry as a strategic tool for staying ahead in a competitive market.

The Summer Internship is a fully practical oriented course which has been designed to give students in depth knowledge about. Summer Internship is designed at the end of first year, where in student would have studied the courses in science and technology and will have more scope to apply knowledge. In this subject, wherein he will be encouraged to explore concepts already dealt in the class and understand its application in the field. The student while carrying summer internship training Project is more focused and would be getting continuous guidance from the external as well as internal experts. The following note presents the broad guidelines of the Project.

PROCESS / GUIDELINES:

1. The student will be required to undergo a field placement for a total duration of 3-4 weeks in their chosen area of interest. Or institute will depute the students to various organizations looking at their area of interest.
2. In case the student makes the choice of the organization, it has to be made in consultation with the Institute. The Institute for this purpose should assign an internal faculty member who will act as the mentor throughout the Project. The assignment of mentor and choice of project should be made.
3. The study conducted by the student will be a full-time effort.
4. The proposal for the Summer Project or title of the project should be submitted to the Institute, which will ensure the registration of students for Project.
5. Students should prepare these proposals in consultation with the Internal and External Guide.
6. Students should send Joining Report on the first day of the joining which should be duly signed by the external guide.
7. Student should also send weekly reports every week keeping posted about the work –in –progress regarding project to the institute.
8. The format for the proposal or deciding about project title is as given below:
    a. Title of the study
    b. Need for the study (Stress on Need for study-current trends in the area)
    c. A review of earlier research studies conducted
    d. Objectives of the study
    e. Methodology
    f. Proposed outcomes and benefits of the study
9. The project should complete in time. Late submissions should not be entertained. A soft copy of all reports is to be submitted to Department on or before the submission date.
10. There shall be 2 copies of project reports along with soft copy to be submitted by each student to the School.
11. There will be a project viva-voice conducted by the University.

DELIVERABLES:

The students are required to deliver the following Deliverables.

1. Joining Report and deciding project title/ proposal
2. Submission of project report (Soft copy + Hard copy- 2no.s /Project)
3. Presentation (for organization and the Institute)
4. Presentation for Viva-voce examination to be conducted by the University.
5. Student to present 1 copy to the organization and get the Certificate.

Format for Project Reports

The format for the Major Concurrent Project reports should be in the following manner.

1. Executive Summary
2. About the organization – Brief
3. Certificate of Completion
4. Introduction of the study
5. Objectives
6. Analysis and Findings
7. Discussion
8. Conclusion
9. References

In certain cases, students may change the format in consultation with his mentor and the External Guide. Enough care should be taken that the Project report focuses the study undertaken by the student and its findings.

The report should contain minimum 25 pages with the following styles:

i. A-4 size paper (Executive Bond)
ii. MS Word style with Times New Roman Font
iii. Font size -12 for Text and 14 for headings
iv. iv) Paper settings with 1-inch margins on all the four sides.

Subject Code	Name of the Laboratory	L	T	P	C
CS- 5091	**Software Engineering Lab**	**0**	**0**	**4**	**2**

CourseObjectives: -

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Methods and strategies of Software design, coding and testing
CO2. Software Reliability and Quality Management.
CO3. ISO 9000: Modern Trends and Emerging Technologies.
CO4. Agile software development, Extreme Programming (XP), Service-oriented and Aspect-oriented Software Development.

LIST OF EXPERIMENTS

1 Develop requirements specification for a given problem (The requirements specification Should include both functional and non-functional requirements. For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)

2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required)

3: Develop structured design for the DFD model developed
4: Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)
5: Develop Sequence Diagrams.
6: Develop Class diagrams.
7: Develop code for the developed class model using Java.
8: Use testing tool such as Junit.
9: Use a configuration management tool.
10: Use any one project management tool such as Microsoft Project or Gantt Project, etc.

4th Semester [Second Year]

Subject Code	Name of the Subject	L	T	P	C
CS- 5002	**Artificial Intelligence**	**3**	**1**	**0**	**4**

Course Educational Objectives

1. Introduce machine intelligence, problem solving, heuristic search
2. Introduce game playing.
3. Provide and introduction to various knowledge representation techniques, reasoning, and expert systems.
4. Introduce planning and learning in AI.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Understand and analyze different AI related state space search techniques.

CO2. Outline and model simple knowledge-based systems.

CO3. Apply knowledge representation techniques and identify algorithms for reasoning with knowledge.

CO4. Identify appropriate planning and learning algorithm to enhance AI problem solving.

SYLLABUS

UNIT:1 **(10 Hours)**

What is Artificial Intelligence? AI Technique, Level of the Model, Problem Spaces, and Search: Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, and Issues in the Design of Search Programs. Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis

UNIT:2 **(10 Hours)**

Knowledge Representation: Representations and Mappings, Approaches to Knowledge Representation, **Using Predicate Logic**: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction. **Using Rules**: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge. **Symbolic Reasoning**

Under Uncertainty: Introduction to Non monotonic Reasoning, Logics for Non monotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Depth-first Search, and Breadth-first Search. **Weak and Strong Slot-and-Filler Structures**: Semantic Nets, Frames, Conceptual Dependency Scripts, CYC.

UNIT:3 **(10 Hours)**

Game Playing: The Mini-max Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening. **Planning**: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Other Planning Techniques. **Understanding**: What is Understanding, What Makes Understanding Hard?, Understanding as Constraint Satisfaction.

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

UNIT:4 **(10 Hours)**

Learning: Rote Learning, Learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. **Expert Systems**: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009*

Reference Books:

1. *Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010*
2. *S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011*

Subject Code	Name of the Subject	L	T	P	C
CS- 5004	**Computer Networks & Security**	**3**	**1**	**0**	**4**

Course Objectives

1. To discuss the digital data communication techniques & gain knowledge on basic concepts of data communication layers, protocols and performance
2. Understand a few representative protocols and network components
3. To introduce the functions of different layers from deployed examples
4. To provide introduction to the concept of Network Security Model and Cryptography systems & give the knowledge of Digital Signature and other Security Measures available.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Understand the basic concepts on data communication layers, protocols and performance & describe the hardware and software commonly used in data communications.

CO2. Analyze the services and features of various layers of data networks

CO3. Design, implement and analyze simple networks that need data communication.

CO4. Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security.

CO5. Classify various Algorithms to be used at various TCP/IP Layers & to operate Digital Signature in Real World Situation.

SYLLABUS

UNIT:1 **(12 Hours)**

Overview of Data Communications and Networking.

Networks models – TCP/IP Protocol Suite, OSI model – Layers in OSI Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital and Analog Data; Transmission Media: Guided Media, Unguided media (wireless) Circuit switching: Circuit switching (Data gram Networks and Virtual circuit networks)

UNIT:2 **(12 Hours)**

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC. Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack, Multiple Access Random Access, Controlled Access, Channelization.

UNIT:3 **(10 Hours)**

Local area Network: Ethernet. Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Network Layer:

Host to Host Delivery: Internetworking, addressing and Routing Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6

Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service. **Application Layer:**Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

UNIT:4 **(10 Hours)**

Fundamentals of Security, Definitions & challenges of security, OSI security architecture, attacks & services. Cryptography & cryptanalysis. Classical encryption techniques, substitution techniques, transposition techniques. Block ciphers, DES, AES structure, DES.Public Key Crypto Systems, principles, RSA algorithm, Diffie-Hellman key exchange, Symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys

. **Hash Functions:**Cryptographic hash functions, applications, security requirements, hash function based on block chaining, SHA-512.

MAC Codes & Digital Signatures:MAC, security requirements, HMAC, CMAC, key wrapping, Digital signatures

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. *William Stallings, Cryptography & Network Security- Principles and Practices, Sixth Edition, Pearson Publishers, 2014.*

Reference Book:

1. Computer Networks: A system Approach: Larry L, Peterson and Bruce S. Davie, Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings,Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks*:* Gupta, Prentice Hall of India Network for Computer Scientists & Engineers: Zheng, Oxford University Press

Subject Code	Name of the Subject	L	T	P	C
CS- 5032	**Machine Learning**	**3**	**1**	**0**	**4**

Course Objectives

1. Introduce Basics of Matrices, Random Variables and Distributions relevant for the study of Machine Learning Techniques
2. Formulate a well-defined machine learning problem with clear Metrics
3. Familiarize with techniques for Dimensionality reduction and Computational Efficiency
4. Understand the notions of Hypotheses Space, Hypotheses Structure and Search

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Identify and classify different categories of Data attributes, Dimensions, Sample sizes

CO2. Understand and Apply Supervised, Unsupervised Learning techniques

CO3. Discriminate classifications based on Logistic and Linear Regression and Function Estimation

CO4. Write Rules and Associations for impactful recommendations from data.

SYLLABUS

UNIT:1 **(10 Hours)** **Introduction:** Learning Problems ,Designing Learning systems, Perspectives and Issues ,Concept Learning ,Version Spaces and Candidate Elimination Algorithm ,Inductive bias ,Decision Tree learning ,Representation ,Algorithm, Heuristic Space Search. **Analytical learning and reinforced learning:** Perfect Domain Theories ,Explanation Based Learning, Inductive, Analytical Approaches ,FOCL Algorithm, Reinforcement Learning, Task – Q-Learning, Temporal Difference Learning
UNIT:2 **(10 Hours)** Neural networks and genetic algorithms: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.
UNIT:3 **(10 Hours)** Bayesian and computational learning: Bayes Theorem ,Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier ,Gibbs Algorithm, Naïve Bayes Classifier ,Bayesian Belief Network ,EM Algorithm ,Probably Learning ,Sample Complexity for Finite and Infinite Hypothesis Spaces ,Mistake Bound Model.
UNIT:4 **(10 Hours)** Instant based learning and learning set of rules: K- Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rule, Induction as Inverted Deduction , Inverting Resolution.
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Books: 1. *Tom M. Mitchell,(2013), Machine Learning, McGraw-Hill Education (INDIAN EDITION*
Reference Books: 1. *EthemAlpaydin, (2013), Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd.*

Subject Code	Name of the Subject	L	T	P	C
CS- 5034	**Computer based Optimization Techniquies**	**3**	**1**	**0**	**4**

Course Educational Objectives

1.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1.

SYLLABUS

UNIT-I:
Descriptive Statistics, and Hypothesis Testing, Descriptive Statistics- Measures of central tendency, Simple regression and correlation - Estimation using regression line, correlation analysis Hypothesis Testing - Two sample tests - testing for difference between proportions, probe values Chi-square and analysis of variance - chi-square as test of independence, chi-square as a test of goodness of fit, analysis of variance, t-distribution

Unit-II
Probability - Basic terminology, types, Probability rules, Statistical independence, statistical dependency, Bayes' theorem Probability distributions - random variables, expected values, binomial distribution, Poisson distribution, normal distribution, choosing correct distribution Sampling and sampling distributions - Random sampling, design of experiments, sampling distributions, operational considerations in sampling

Unit-III
Introduction to optimization technique: History, objective, decision making: decision making environment (certain and uncertain), decision making criteria (probabilistic and non-probabilistic), Linear Programming: Mathematical formulation of Linear Programming problem, problem, Solution by Graphical and Simplex methods, Revised Simplex method, Duality, Primal –Dual relationship, Dual Simplex method.

UNIT:4 **(10 Hours)**
Special Types of Linear Programming Problem: Integer Programming: Branch and bound method and Gomory cutting plane method. Transportation problem, Northwest corner method, Stepping stone method, Unbalanced transportation problem, Assignment problem, The Hungarian method, Machine scheduling: n-jobs on two machine, n-jobs on three machines, two jobs through n machine, and n jobs through m machines

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Douglas C. Montgomery & George C. Runger "Applied Statistics and Probability for Engineers " (6e) Wiley ISV Paperback – 1 January 2016*

Reference Books:

1. F S Hillier and G J Lieberman, Introduction to Operations Research, 7th edition, McGraw Hill, 2000
2. 3. H A Taha, Operations Research –An Introduction, 8th Edition, Pearson Prentice Hall, 2007.

Subject Code	Name of the Subject	L	T	P	C
CS- 5036	**Cyber Security**	**3**	**1**	**0**	**4**

Course Educational Objectives

1. To study the concepts and principles of Cyber Security.
2. To understand the various security threats and the ways to overcome them effectively.
3. To know the effectiveness of various network and data security toolkits

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. State the need and scope for cyber laws.

CO2. Explain various network attacks; describe their sources, and mechanisms of prevention.

CO3. Describe the genesis of SCADA policies and their implementation framework.

CO4. To carry out malware analysis using simulations.

SYLLABUS

UNIT:1Introduction:

Cyberspace, Internet, Internet of things, Cyber Crimes, cyber criminals, Cyber security, Cyber Security Threats, Cyber laws and legislation, Law Enforcement Roles and Responses

Unit-II Network Attacks:

Network Threat Vectors, MITM, OWAPS, ARP Spoofing, IP & MAC
Spoofing, DNS Attacks, SYN Flooding attacks, UDP ping-pong and fraggle attacks, TCP port scanning and reflection attacks, DoS, DDOS. Network Penetration Testing Threat assessment, Penetration testing tools, Penetration testing, Vulnerability Analysis, Threat matrices, Firewall and IDS/IPS, Wireless networks, Wireless Fidelity (Wi-Fi), Wireless network security protocols, Nmap, Network fingerprinting, BackTrack, Metasploit.

Unit-III Introduction to SCADA (supervisory control and data acquisition):

Understanding SCADA security policies, SCADA Physical and Logical Security, Understanding differences between physical and logical security, Define perimeter controls and terms, Define various security zones, Understand communication cyber threats, Understand firewall, architectures.

UNIT:4 **(10 Hours)**

Unit-IV Introduction Malware Analysis: Static Analysis, Code Review, Dynamic Analysis, Behavioral analysis of malicious executable, Sandbox Technologies, Reverse-engineering malware,Defeat anti-reverse engineering technique, automated analysis, intercepting network connections, Network flow analysis, Malicious Code Analysis, Network analysis, Anti-disassembling techniques, Identifying assembly logic structures with a disassembler.Malware Handling: Malicious Documentsand Memory Forensics - Reverse engineering of malicious executable using memory forensic techniques, Analyze malicious Microsoft Office (Word, Excel, PowerPoint) and Adobe PDF documents, Analyzing memory to assess malware characteristics and reconstruct infection artifacts.

Using memory forensics to analyze rootkit infections, Legal & Ethical Issues - Reinforce understanding and the application of discipline specific legal and ethical issues, Reverse Engineering Malware (REM) Methodology

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “ComputerOrganization and Embedded Systems”, Sixth Edition, Tata McGraw Hill, 2012.
2. David A. Patterson and John L. Hennessy, “Computer Organization and Design: TheHardware/Software Interface”, Fourth Edition, Morgan Kaufmann / Elsevier, 2009.
3. Kai Hwang and F.A. Briggs, “Computer Architecture and Parallel Processing”, McGraw Hill.

Reference Books:

1. M. Morris Mano, “Computer System Architecture”, PHI
2. William Stallings, “Computer Organization and Architecture – Designing forPerformance”,

Sixth Edition, Pearson Education, 2003.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
4. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

Subject Code	Name of the Subject	L	T	P	C
CS- 5038	**Big Data Analytics**	**3**	**1**	**0**	**4**

Course Objectives

1. Provide an insight into Data pre-processing, summarization, and visualization techniques.
2. Teach role of data analytics in business decision making.
3. Teach Model building and validation using various techniques.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Understand and build regression models and use them for prediction
CO2. Analyze data to infer underlying patterns and formulate recommendations.
CO3. Outline the scope and limitations of several state-of-the-art data analytics methods.
CO3. Implement different data analytics models in a business environment.

SYLLABUS

UNIT:1 **(10 Hours)**

Predictive Analytics: Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminate Analysis, Logistic regression, Perception learning algorithm.

UNIT:2 **(10 Hours)**

Neural Networks (NN), Support Vector Machines (SVM) and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest–Neighbor classifiers (Image Scene Classification).

UNIT:3 **(10 Hours)**

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

Inferential Statistics and Prescriptive analytics Assessing Performance of a classification Algorithm (t-test, McNemar's test, Paired t-test, paired F-test), Analysis of Variance, Creating data for analytics through designed experiments. Introduction to big data and Challenges for big data analytics.

UNIT:4 **(10 Hours)**

Implementation of following methods using R or Mat lab (One of the class tests with a weight age of 15 marks be used to examine these implementations): Simple and multiple linear regression, Logistic regression, Linear discriminate analysis, Ridge regression, Cross-validation and boot strap, Fitting classification and regression trees, K-nearest neighbors, Principal component analysis, K-means clustering.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Trevor Hastie, Robert Tibshirani,Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference,andPrediction,Second Edition , Springer Verlag, 2009.*

2. *G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,2013.*
3. *E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010.*

Reference Books:

1. *C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006*
2. *L.Wasserman-All of statistics*

Subject Code	Name of the Subject	L	T	P	C
IK-5052	**Indigenous Knowledge and Intellectual Property Rights**	**3**	**1**	**0**	**4**

Course Objectives

Course Outcomes:

Upon successful completion of this course, students should be able to:

SYLLABUS

UNIT:1

Introduction to Intellectual Property Rights: Concept and meaning.

Theories of Property - An Overview, Intellectual Property as an Instrument of Development

Introduction to Patent Law (a) Paris Convention (b) Patent Cooperation Treaty (c) WTO- TRIPS (d) Harmonisation of CBD and TRIPs

UNIT:2

Indian Patent Law (a) The Patents Act, 1970 (b) Amendments to the Patents Act (c) Patentable Subject Matter, Patentability Criteria (d) Procedure for Filing Patent Applications, Patent Granting Procedure (e) Revocation, Patent Infringement and Remedies (f) Relevant Provisions of the Biological Diversity Act, 2002 (g) Access and Benefit Sharing Issues

UNIT:3

Copyright, Neighbouring Rights and Industrial Designs.Introduction to Copyright.

Indian Copyright Law: (a) The Copyright Act, 1957 with its amendments (b) Copyright works (c) Ownership, transfer and duration of Copyright (d) Renewal and Termination of Copyright (e) Neighbouring Rights (f) Infringement of copyrights and remedies

Industrial Designs (a) Need for Protection of Industrial Designs (b) Subject Matter of Protection and Requirements (c) The Designs Act, 2000 (d) Procedure for obtaining Design Protection (e) Revocation, Infringement and Remedies

UNIT:4

Geographical Indications, Layout designs of Integrated Circuits and Protection of Plant Varieties and Farmers' Rights.

Geographical Indications: Concept of Appellations of Origin, Indication of Source and Geographical Indication, The Geographical Indications of Goods, Infringement, Penalties and Remedies.

Layout-Designs of Integrated Circuits: Conditions and Procedure for Registration, Duration and

Effect of Registration, Assignment and Transmission

The Protection of Plant Varieties and Farmers' Rights: The Protection of Plant Varieties and Farmer's Rights Act, 2001., Protection of Plant Varieties and Farmers' Rights, Registration of Plant Varieties and Essentially derived variety, Duration, Effect of Registration and Benefit Sharing, Farmers' Rights, Plant Varieties Protection Appellate Tribunal, Infringement, Offences, Penalties and Procedure

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Arai, Hisamitsu. "Intellectual Property Policies for the Twenty-First Century: The Japanese Experience in Wealth Creation", WIPO Publication Number 834 (E). 2000. wipo.int
2. Bettig, R. V. (1996). Critical Perspectives on the History and Philosophy of Copyright. In R. V. Bettig, Copyrighting Culture: The Political Economy of Intellectual Property. (pp. 9–32). Boulder, CO: Westview Press.
3. Boldrin, Michele and David K. Levine. "Against Intellectual Monopoly", 2008. dkleving.com
4. Branstetter, Lee, Raymond Fishman and C. Fritz Foley. "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from US Firm-Level Data". NBER Working Paper 11516. July 2005. weblog.ipcentral.info
5. Burk, Dan L. and Mark A. Lemley (2009). The Patent Crisis and How the Courts Can Solve It. University of Chicago Press. ISBN 978-0-226-08061-1.
6. Connell, Shaun. "Intellectual Ownership". October 2007. rebithofffreedom.org
7. De George, Richard T. "14. Intellectual Property Rights." In The Oxford Handbook of Business Ethics, by George G. Brenkert and Tom L. Beauchamp, 1:408-439. 1st ed. Oxford, England: Oxford University Press, n.d.
8. Farah, Paolo and Cima, Elena. "China's Participation in the World Trade Organization: Trade in Goods, Services, Intellectual Property Rights and Transparency Issues" in Aurelio Lopez-Tarruella Martinez (ed.), El comercio con China. Oportunidadesempresariales, incertidumbresjurídicas, Tirant lo Blanch, Valencia (Spain) 2010, pp. 85–121. ISBN 978-84-8456-981-7. Available at SSRN.com
9. Farah, Paolo Davide, Tremolada Riccardo, Desirability of Commodification of Intangible Cultural Heritage: The Unsatisfying Role of IPRs, in TRANSNATIONAL DISPUTE MANAGEMENT, Special Issues "The New Frontiers of Cultural Law: Intangible Heritage Disputes", Volume 11, Issue 2, March 2014, ISSN 1875-4120Available at SSRN.com
10. Farah, Paolo Davide, Tremolada Riccardo, Intellectual Property Rights, Human Rights and Intangible Cultural Heritage, Journal of Intellectual Property Law, Issue 2, Part I, June 2014, ISSN 0035-614X, Giuffre, pp. 21–47. Available at SSRN.com

Subject Code	Name of the Subject	L	T	P	C
CS- 5006	**Problem Solving Using Python and R**	**2**	**0**	**0**	**2**

Course Objectives

1. To write simple Python programs using Python data structures.
2. To develop object-oriented programs in Python
3. To manipulate files using Python.
4. To work on few Python packages
5. To write simple R programs for statistical computing

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1. Write programs using Python data structures.
CO2. Develop solutions to real world problems using object-oriented concepts
CO3. Read and write data from/to files using Python.
CO4. Make use of Python Modules and Packages to solve complex problems
CO5. Write simple R programs for statistical computing.

SYLLABUS

UNIT:1

Problems solving fundamentals, Python: variables, expressions, statements, precedence of operators; Data structures: list, Dictionary, tuples; Lists: list slices, list methods, mutability, cloning lists, List comprehension; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; Conditional constructs; Iterative constructs. Strings: string slices, immutability, string functions and methods;

UNIT:2

Functions: parameters, return values, local and global scope, function composition, recursion, and lambda functions.
Object orientation – Classes, Objects, methods, Operator overloading, and Inheritance. Files and exception: text files, reading and writing files, format operator; errors and exceptions, handling exceptions; creating modules and packages.

UNIT:3

Python Modules and Packages: Python Standard Library, Numpy, Pandas, Matplotlib, GUI - Tkinter, wxWidgets ; Database- MySQLDB, Scikit-Learn, NL

UNIT:4

R Programming - Control Structures - Functions - Data Manipulation - String Operations- Data Visualization – R for Statistical computing.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd edition, Updated for Python 3, O‘Reilly Publishers, 2016
2. Zed Shaw's ,”Learn Python the Hard Way: A Very Simple Introduction to the
3. Terrifyingly Beautiful World of Computers and Code, Addison-Wesley Professional; edition, 2013
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in
4. Python: An Inter - disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Paul Teetor, R Cookbook- Proven Recipes for Data Analysis, Statistics, and Graphics, O'Reilly Media, 2011
5. Wesley J Chun, Core Python Programming , 2nd edition, Prentice Hall ,2009