ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

M.E. COMPUTER SCIENCE AND ENGINEERING
(Two-Year Full Time) DEGREE PROGRAMME
Choice Based Credit System
Regulations & Curriculum – 2023

HAND BOOK
2023

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
M.E. (Two -Year Full Time) DEGREE PROGRAMME (CBCS)
REGULATIONS - 2023

1. **Conditions for Admission**
   Candidates for admission to the first year of the four-semester **M.E Degree Programme in Engineering** shall be required to have passed B.E / B.Tech degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalentthereto. Theyshall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai Universityfromtime to time.

2. **Branches of Study in M.E**
   The Branch and Eligibility criteria of Programmes are given in Annexure

3. **Courses of Study**
   The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E Programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given in Annexures of the respective Departments.

4. **Choice Based Credit System (CBCS)**
   The curriculum includes Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to the Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. **Assignment of Credits for Courses**
   Each course is normally assigned one credit per hour of lecture / tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the Programme will be **68**.

6. **Duration of the Programme**
   A student of M.E Programme is normally expected to complete in four semesters for the full-time but in any case not more than four years from the date of admission.

7. **Registration for Courses**
   A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This

registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day. Registration for the Thesis Phase - I and Phase-II shall be done at the appropriate semesters.

8. Electives

8.1 Program Electives

The student has to select two electives in first semester, another two electives in the second semesterand onemore in the third semester fromthe list of Program Electives.

8.2 Open Electives

The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	08 marks
Second assessment (Mid-Semester Test-II)	:	12 marks
Third Assessment	:	05 marks
End Semester Examination	:	75 marks

10.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

Firstassessment(Test-I)	:	15 marks
Secondassessment(Test-II)	:	15 marks
Maintenanceofrecordbook	:	10 marks
End Semester Examination	:	60 marks

10.3 Thesis Work

The thesis Phase-I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors (Mentors)

To help the students in planning their course of study and for general advice on the academic Programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentor) for those students throughout their period of study.

12. Class Committee

For each of the semesters of M.E programmes separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase - I and II) shall be appointed by the Head of the Department from among the Thesissupervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will bedecided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. Temporary Break of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid- semester test. However, the student must complete the entire Programme within the maximum period of **four years.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice - Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing and Declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

90 to 100 marks	Grade S‘
80 to 89 marks	Grade A‘
70 to 79 marks	Grade B‘
60 to 69 marks	Grade C‘
55 to 59 marks	Grade D‘
50 to 54 marks	Grade E‘
Less than 50 marks	Grade RA‘
Withdrawn from the Examination	Grade W‘

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA – 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the Programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 68 credits within four semesters from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 68 credits within two years and six months from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 68 credits within four years from the time of admission.

The conversion of OGPA/CGPA (from I semester to IV Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

Where $OGPA/CGPA = \frac{\sum C_i GP_i}{\sum C_i}$

$_i$- Credit hours of a course

$_i$ - Grade Point of that course

18. Ranking of Candidates

The candidates who are eligible to get the M.E degree in First Class with Distinction will berankedonthebasis of CGPAforallthecourses ofstudy from ItoIV semester.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to IV semester.

19. Transitory Regulations

If a candidate studying under the old regulations M.E could not attend any of the courses in his/her courses, shall be permitted to atend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

ANNEXURE

S. No.	Department		Programme (Full Time)	Eligible B.E. / B.Tech Programme
1	Civil Engineering	i	Environmental Engineering	B.E. / B.Tech - Civil Engineering, Civil &Structural Engineering, Environmental Engineering, Mechanical Engineering, Industrial Engineering, Chemical Engineering, Bio Chemical Engineering, Biotechnology, Industrial Biotechnology, Chemical & Environmental Engineering.
		ii	Water resources Engineering & Management	B.E. / B.Tech - Civil Engineering, Civil &Structural Engineering, Environmental Engineering, Mechanical Engineering, Agricutural and irrigation Engineering, Geo informatics, Energy and Environmental Engineering.
2	Civil & Structural Engineering	i	Structural Engineering	B.E. / B.Tech - Civil Engineering, Civil & Structural Engineering.
		ii	Construction Engineering. and Management	
3	Mechanical Engineering	i	Thermal Power	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Mechanical Engineering (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Mechanical (Manufacturing) Engineering, Chemical Engineering
4	Manufacturing Engineering	i	Manufacturing Engineering	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Manufacturing Engineering, Production Engineering, Marine Materials science Engineering,Metallurgy Engineering, Mechatronics Engineering and Industrial Engineering.
5	Electrical Engineering	i	Power System Engineering	B.E. / B.Tech - Electrical and Electronics Engineering,
6	Electronics & Instrumentation Engineering	i	Process Control & Instrumentation	B.E. / B.Tech - Electronics and Instrumentation Engineering, Electrical and Electronics Engineering, Control and Instrumentation Engineering, Instrumentation Engineering, , Electronics and Communication Engineering,
7	Chemical Engineering	i	Chemical Engineering	B.E. / B.Tech - Chemical Engineering, Petroleum Engineering, Petrochemical Technology
		ii	Food Processing Technology	B.E. / B.Tech - Chemical Engineering, Food Technology,Biotechnology, Biochemical Engineering, Agricultural Engineering.
8	Computer Science and Engineering	i	Computer Science and Engineering	B.E. / B.Tech - Computer Science and Engineering, Computer Science and Engineering (Artificial Intelligence and Machine Learning), Computer Science and Engineering (Data Science), Information Technology, Electronics & Communication Engineering, Software Engineering
9	Electronic & Communication Engineering	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engineering, Electronics Engineering.

DETAILS OF COURSE CODE

S. No	3rd & 4th Digits	DETAILS		5th & 6th Digits	DETAILS	7th & 8th Digits	DETAILS
1	CE	Civil Engineering	i	WR	Water Resources Engineering & Management	PC	Program Core
			ii	EE	Environmental Engineering		
2	CZ	Civil & Structural Engineering	i	SE	Structural Engineering	PE	Program Elective
			ii	CM	Construction Engineering. and Management		
3	ME	Mechanical Engineering	i	TP	Thermal Power Engineering	OE	Open Elective
			ii	EM	Energy Engineering & Management		
4	MF	Manufacturing Engineering	i	ME	Manufacturing Engineering	CP	Core Practical
5	EE	Electrical Engineering	i	PS	Power System Engineering	TS	Industrial Training and Seminar
6	EI	Electronics & Instrumentation Engineering	i	PC	Process Control & Instrumentation	PV	Project work & Viva-voce
7	CH	Chemical Engineering	i	CE	Chemical Engineering	MC	Mandatory Learning Course
			ii	FT	Food Processing Technology		
8	CS	Computer Science and Engineering	i	CS	Computer Science and Engineering	AC	Audit Course
9	EC	Electronics & Communication Engineering	i	CS	Communication Systems		
10	YY	Name of the Department					
11	ZZ	Name of the Program					

The first two digits relate to the year from which the Regulations commence 9th digit represents the semester and 10th digit represents the serial number of courses. YY and ZZ relates to the Open Elective where YY corresponds to Name of the Department and ZZ to Name of the Program.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(REGULATION-2023)

M.E (COMPUTER SCIENCE) DEGREE PROGRAMME

(FULL TIME) CHOICE BASED CREDIT SYSTEMS

COURSES OF STUDY AND SCHEME OF EXAMINATION

SEMESTER I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CSCSPC11	**PC-I**	Advanced Data Structures	3	-	-	25	75	100	3
23CSCSPC12	**PC-II**	Machine Learning	3	-	-	25	75	100	3
23CSCSPE13	**PE-I**	Program Elective-I	3	-	-	25	75	100	3
23CSCSPE14	**PE-II**	Program Elective-II	3	-	-	25	75	100	3
23CSCSMC15	**MC-I**	Research Methodology and IPR	2	-	-	25	75	100	2
23CSCSCP16	**CP-I**	Advanced Data Structures Lab	-	-	3	40	60	100	2
23CSCSCP17	**CP-II**	Machine Learning Lab	-	-	3	40	60	100	2
23CSCSAC18	**AC-I**	Audit Course-I	2	-	-	-	-	-	0
			Total			205	495	700	**18**

SEMESTER II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CSCSPC21	**PC-III**	Analysis of Algorithms	3	-	-	25	75	100	3
23CSCSPC22	**PC-IV**	Embedded Control Systems and Internet of Things (IoT)	3	-	-	25	75	100	3
23CSCSPE23	**PE-III**	Program Elective-III	3	-	-	25	75	100	3
23CSCSPE24	**PE-IV**	Program Elective-IV	3	-	-	25	75	100	3
23CSCSOE25	**OE-I**	Open Elective	3	-	-	25	75	100	3
23CSCSCP26	**CP-III**	Embedded Control Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	2
23CSCSTS27	**TS-I**	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2
23CSCSAC28	**AC-II**	Audit Course-II	2	-	-	-	-	-	0
			Total			205	495	700	**19**

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CSCSPE31	**PE-V**	Program Elective-V	3	-	-	25	75	100	3
23CSCSOE32	**OE-II**	Open Elective	3	-	-	25	75	100	3
23CSCSPV33	**PV-I**	Project work & viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10
			Total			90	210	300	**16**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CSCSPV41	**PV-II**	Project work & viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15
			Total			40	60	100	**15**

L- Lecture ; **P-** Practical; **T-** Thesis; **CA-** Continuous Assessment; **FE-** Final Examination

Branch Code		**M.E Specialization**		**Category**		**Sem No.**	**Course No.**
Computer Science and Engineering		Computer Science and Engineering		Program Core / Program Elective/ Open Elective / Core Practical			
X	**X**	**Y**	**Y**	**P**	**C**	**1**	**1**
C	**S**	**C**	**S**	**P**	**C**	**1**	**1**

Course Code EXAMPLE

LIST OF PROGRAMME ELECTIVES

1. Wireless and Mobile Networks
2. Computer Vision
3. Advanced Image Processing
4. Wireless Sensor Networks
5. Knowledge based Systems
6. Distributed Systems
7. Web Engineering
8. Data Preparation and Analysis
9. Secure Software Design & Enterprise Computing
10. Graphics Processing Unit (GPU) Computing
11. Digital Forensics
12. Mobile Applications and Services
13. Optimization Techniques
14. Data Mining and Warehousing
15. Speech and Audio Signal Processing
16. Networks and Information Security
17. Digital Video Processing
18. Medical Image Processing
19. Mobile adhoc Networks
20. Computer Network Engineering and Management

LIST OF OPEN ELECTIVES

1. Data Science
2. Internet of Things (IoT)
3. Big Data Analytics
4. Cloud Computing Technologies
5. Advanced Web Design
6. Human and Computer Interaction
7. Soft Computing

LIST OF AUDIT COURSES I and II

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills
9. Intellectual Property Rights

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To provide congenial academic environment for individuals to develop and blossom as academically superior, nationally responsible and socially conscious citizens.

MISSION

M1: Impart high quality computer knowledge to the students through a dynamic scholastic environment wherein they learn to develop technical, communication and leadership skills to bloom as a versatile professional.

M2: Develop life-long learning ability that allows them to be adaptive and responsive to the changes in career, society, technology, and environment.

M3: Build student community with high ethical standards to undertake innovative research and development in thrust areas of national and international needs.

M4: Expose the students to the emerging technological advancements for meeting the demands of the industry.

PROGRAMME OUTCOMES (POs)

After the successful completion of M.E CSE (Artificial Intelligence and Machine Learning) Programme the students will be able to:

PO1:Scholarship of Knowledge

Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2:Critical Thinking

Analyse complex engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3:Problem Solving

Think laterally and originally, conceptualise and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4:Research Skill

Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO5:Usage of modern tools

Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

PO6:Collaborative and Multidisciplinary work

Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7:Project Management and Finance

Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

PO8:Communication

Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: Life-long Learning

Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10: Ethical Practices and Social Responsibility

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11: Independent and Reflective Learning

Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: To prepare the graduates with the potential to get employed in the right role and/or become entrepreneurs to contribute to the society.

PEO2: To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science.

PEO3: To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.

PEO4: To train the graduates to communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Apply standard Software Engineering practices and strategies in real-time software project development using open-source programming environment or commercial environment to deliver quality product for the organization success.

PSO2: Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics of varying complexity.

PSO3: Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems.

CONSISTENCY OF PEOs WITH MISSION OF THE DEPARTMENT

PEO Statements	Mission Statements			
	M1	M2	M3	M4
PEO1: To prepare the graduates with the potential to get employed in the right role and/or become entrepreneurs to contribute to the society.	2	3	2	3
PEO2: To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science.	2	2	3	2
PEO3: To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.	2	3	2	3
PEO4: To train the graduates to communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.	3	3	2	3

Mapping of PEOs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PEO1	3	3	2	2	3	1	1	2	2	1	2
PEO2	3	3	2	2	2	-	-	1	2	-	-
PEO3	2	2	2	1	3	1	-	2	3	1	2
PEO4	2	2	1	1	2	1	2	3	1	2	2

23CSCSPC11	ADVANCED DATA STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable the student to choose appropriate data structures, understand the ADT/libraries and hashing.
- To familiarize the concept of tree structures.
- To disseminate the knowledge on advanced paradigms and data structures used to solve algorithmic problems.
- To teach about text processing and pattern matching.
- To disseminate the knowledge on analysis of efficiency and proofs of correctness.

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, open addressing, linear probing, Quadratic probing, Double hashing, rehashing, extendible hashing.

Skip Lists: Need for randomizing data structures and algorithms, search and update operations on skip lists, probabilistic analysis of skip lists, deterministic skip lists.
Trees: Binary search trees, AVL trees, red black trees, 2-3 trees, B-Trees, Splay trees.

Text Processing: String operations, Brute-force Pattern matching, The Boyer-Moore algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad Trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “Introduction to Algorithms", Second Edition, MIT Press, McGraw Hill,2001.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey d. Ullman, “The Design and Analysis of Computer Algorithms”, Addison-Wesley Publishing Company,1974.
3. Jon Kleinberg, Eva Tardos, “Algorithm Design”, Pearson Addison Wesley,2005.
4. Robert Sedgewick, Philippe Flajolet, “ An Introduction to the Analysis of Algorithms”, 2nd Edition, Addison Wesley,2013.

Course Outcomes:

After the completion of the course, the students will be able to

1. Understand the implementation of symbol table using hashing techniques
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Build algorithms for text processing applications.
4. Identify suitable data structures and develop algorithms for problems involving Tree structure.
5. Implement different computational geometry methods sand analyze their complexities for solving new evolving problems

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-
CO3	2	1	2	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	-	-	-	-	-	-	-

23CSCSPC12	**MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of machine learning, types of learning and normal densities.
- To familiarize the component analysis techniques and clustering algorithms.
- To provide in-depth knowledge on different classification algorithms used in machine learning.
- To illustrate the deep learning architectures used for modeling spatial and temporal features.
- To explain different methods of combining machine learning algorithms for solving real world problems

Bayesian Decision Theory and Normal Distribution: Machine perception - feature extraction - classification, clustering, linear and logistic regression. Types of learning. Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

Component analysis and Clustering Algorithms: Principal component analysis - Linear discriminant analysis - Independent component analysis. K-means clustering - fuzzy k-means clustering - Expectation-maximization algorithm-Gaussian mixture models – auto associative neural network.

Classification Algorithms: Perceptron and back propagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbor rule. Support vector machine: multi-category generalizations - Regression. Decision trees: classification and regression tree - random forest.

Deep Learning Architectures and Applications: Convolution neural networks (CNN) - Layers in CNN - CNN architectures. Recurrent Neural Network. Applications: Speech-to-text conversion-image classification-time series prediction.

Combining Multiple Learners: Generating diverse learners - model combination schemes voting-error-correcting output codes - bagging-boosting –mixture of experts revisited -stacked generalization- fine-tuning an ensemble – cascading. Recent trends in various learning techniques of machine learning and classification methods for solving real world problems.

References:

1. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", Second edition, John Wiley & Sons, Singapore,2003.
2. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition,2014.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer,2006.
4. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press,2012.
5. Francois Chollet, "Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018. (freely availableonline)
6. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018. (freely availableonline)

Course Outcomes:

After the completion of the course, the students will be able to

1. Understand univariate and multivariate Gaussian densities, and Bayesian belief networks and recurrent neural networks.
2. Implement principal component analysis, k-means clustering and Gaussian mixture modeling.
3. Compare the classification algorithms including radial basis function neural network, support vector machine, and classification and regression tree.
4. Design deep learning architectures for modeling spatial and temporal features using convolution
5. Combine two more classification algorithms to construct an efficient method for solving real world problems.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-
CO4	2	3	3	2	2	-	-	-	-	-	-
CO5	2	3	3	1	-	-	-	-	-	-	-

23CSCSMC15	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
		2	0	0	2

Course Objectives:

- To enable the student to understand the sources, criteria characteristics, scope and objectives of the research problem and investigation of solutions .
- To familiarize with literature studies approach.
- To explain the nature of intellectual property, international scenario.
- To educate the nature of patent Rights.
- To impart skills on case study of IPR and IIT's

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. C. R. Kothari, Research Methodology – Methods and Techniques, Third Ed., New Age International Publishers, New Delhi,2014.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta, 2001.
3. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", Juta and Company,1996
4. RanjitKumar,"Research Methodology: A Step by Step Guide for beginners", 2nd edition, Pearson Longman,2005
5. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
Mayall, "Industrial Design", McGraw Hill,1992.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the sources, criteria characteristics, scope, objectives and investigation of solutions for research problem.
2. Analyze literature studies approach, research ethics, writing report, paper development, research proposal, presentation and assessment by review committee.
3. Discuss the nature of intellectual property, process of patenting and development and international scenario.
4. Evaluate the scope of patent rights, patent information and database.
5. Construct novel developments in IPR system and to discuss the case study of IPR and IIT's .

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-
CO3	1	1	2	-	-	-	-	1	-	-	-
CO4	1	1	1	-	-	-	-	1	-	-	-
CO5	1	1	2	1	2	-	-	-	-	-	-

23CSCSCP16	**ADVANCED DATA STRUCTURES LAB**	**L**	**T**	**P**	**C**
		0	0	3	2

Course Objectives:

- To impart programming skills in C++ for implementing advanced data structure techniques.
- To familiarize students with advanced paradigms and data structures to solve algorithmic problems.
- To prepare the students to write programs to solve problems in practical applications of data structures.

LIST OF EXERCISES

CYCLE I

Write a C++ program to implement the following

1. Hashing with chaining.
2. Skip Lists.
3. Binary Search Tree.
4. AVLTrees.
5. B-Trees.

CYCLE – II

1. String matching using Boyer-Moore algorithm.
2. Tree structure.
3. Huffman coding algorithm.
4. One dimensional rang searching.
5. 5.Two dimensional range searching

Course Outcomes:

After the completion of the course, the students will be able to

1. Identify the appropriate data structure for a specific problem.
2. Analyze the time and space efficiency of the data structure.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	2	2	-	-	-	-	-	1	-	-
CO2	1	-	2	-	-	2	-	1	-	-	-
CO3	2	2	-	-	-	-	-	2	-	2	-

23CSCSCP17	MACHINE LEARNING LAB	L	T	P	C
		0	0	3	2

Course Objectives:

- To implement the basic machine learning techniques using Python.
- To apply the convolution neural network architecture using Python.
- To solve the challenging research problems in the area of Speech and Image processing.

LIST OF EXERCISES

CYCLE – I

Write a PYTHON program to implement the following:

1. Linear and logistic regression with error estimation.
2. Univariate and multivariate Gaussian densities.
3. Dimensionality reduction using Principal Component Analysis(PCA).
4. Clustering using
   a) K-means.
   b) Gaussian mixture modeling(GMM).
5. Classification using
   a) Back propagation neural network(BPNN).
   b) Support vector machine(SVM).
6. Construction of decision tree and random forest

CYCLE – II

7. Convolution neural network(CNN).
8. Sequence prediction using recurrent neural network(RNN).
9. Isolated-word speech recognition.
10. Face detection and tracking

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Compare and implement the classification, clustering and regression algorithms.
2. Interpret, Design and implement methods for solving problems using a suitable machine learning technique.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	2	1	-	-	-	-	-	-	-
CO2	2	1	2	1	2	-	-	2	2	-	-
CO3	1	2	-	-	-	-	-	2	-	2	-

23CSCSPC21	**ANALYSIS OF ALGORITHMS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the advanced methods of designing and analyzing algorithms.
- To enable the students to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- To understand different classes of problems concerning their computation difficulties.
- To introduce the students to get familiarity in recent developments in the area of algorithmic design.

Sorting: Review of various sorting algorithms, topological sorting. Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations,LUP-decomposition.

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder theorem, Conversion between base-representation and modulo-representation.

Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest: Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm. Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “Introduction to Algorithms", Second Edition, MIT Press, McGraw Hill, 2001.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey d. Ullman, “The Design and Analysis of Computer Algorithms”, Addison-Wesley Publishing Company, 1974.
3. Jon Kleinberg, Eva Tardos, “Algorithm Design”, Pearson Addison Wesley, 2005.
4. Robert Sedgewick, Philippe Flajolet, “ An Introduction to the Analysis of Algorithms”, 2nd Edition, Addison Wesley, 2013

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Analyze the performance and complexity of sorting algorithms.
2. Understand the concepts of Matroids and compare the performance of Graph Matching algorithms.
3. Design and evaluate the complexity of flow – network algorithms.
4. Implement the various graph algorithms and determined the applications of DFT, FFT and SSIM algorithms.
5. Determine the feasibility of the linear programming techniques by understand NP-Completeness and NP-hard problems.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	2	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-
CO4	2	2	2	2	1	-	-	-	-	-	-
CO5	2	2	2	2	-	1	-	-	-	-	-

23CSCSPC22	**EMBEDDED CONTROL SYSTEMS AND INTERNET OF THINGS (IoT)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basics, classification and purpose, quality attributes, core components and communication interface of embedded systems.
- To educate the students on embedded firmware development languages, an overview of embedded system development environment and fundamental issues in embedded hardware and firmware.
- To teach the students the characteristics, physical/logical design, and functional blocks of IoT.
- To impart knowledge on building IoT with Raspberry Pi, Arduino IDE and various real time applications of IoT.
- To explain the overview of IoE, software, management tools and communication for IoT cloud storage.

Embedded System Vs General Computing System - Classification of Embedded System, Purpose of Embedded system, Quality Attributes of Embedded System -Typical Embedded System- Core of Embedded System, Memory, Sensors and Actuators, Communication Interface- Onboard communication interface, External communication interface.

Embedded Firmware Design Approaches- Embedded Firmware Development Languages - Embedded System Development Environment - IDE, Compiler, Linker - Types of File Generated on Cross Compilation-Simulator, Emulator and Debugging- Fundamental issues in Hardware Software Co-design- Integration and Testing of Embedded Hardware and Firmware.

Introduction-Characteristics - Physical design - protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M. IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services. Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks. Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for IoT – Data Analytics for IoT – Software & Management Tools for IoT.

IoE – Overview – Architecture-Smart objects and LLNs-Secure mobility. Home automation – Cities: Smart parking – Environment: Weather monitoring – Agriculture: Smart irrigation – Data analytics for IoT – Software & management tools for IoT cloud storage models & Communication APIs – Cloud for IoT – Amazon Web Services for IoT.

References:

1. Shibu K.V, "Introduction to Embedded System", Tata McGraw-Hill, 2014.2. ..
2. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, Addison Wesley, 2001
3. Marilyn Wolf, Computers as Components, Principles of Embedded Computing System Design", Morgan Kaufmann Publishers, Third edition, 2012.
4. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
5. Manoel Carlos Ramon, "Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
6. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the classification and purpose, core components and communication interface of embedded systems.
2. Analyze the fundamental issues in embedded hardware and firmware and embedded system development environment.
3. Understand the building blocks of IoT, IoT enabling technologies, characteristics of IoT systems, IoT levels and the difference between IoT and M2M.
4. Design IoT physical devices for real time applications using Raspberry Pi and Arduino.
5. Build domain specific IoT's for home automation, weather monitoring and web services.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	1	-	-	2	2	-	-
CO5	3	1	1	1	2	1	-	1	-	-	-

23CSCSCP26	**EMBEDDED CONTROL SYSTEMS AND INTERNET OF THINGS (IoT) LAB**	**L**	**T**	**P**	**C**
		0	0	3	2

Course Objectives:

- To understand the working principle of Embedded System.
- To make use various sensors in IoT.
- To know how to use various tools in IoT for designing applications.

LIST OF EXERCISES
CYCLE – I

1. Programming and Simulation of 8051 in Keil IDE [Finding average of numbers
2. Alphanumeric LCD interface using 8051
3. Study of ARM evaluation system.
4. Flashing of LEDs using ARM (LPC2148
5. Interfacing keyboard and LCD using ARM (LPC2148).
6. Temperature sensor interface using ARM (LPC2148).
7. Study of FPGA evaluation system
8. Design of logic gates using FPGA.
9. Design of UP/Down counter using FPGA.

CYCLE – II

10. Automatic street light control.
11. Control raspberry Pi using local server.
12. Connect with RTC.
13. Rasberry Pi as Server.
14. Transfer data using serial communication.
15. Smart Jacket with interactive display.
16. Accident alert with location information over Internet.
17. Personalized toy for kids – voice based.
18. Live air pollution monitor over Internet.
19. Interactive humanoid
20. Smart gloves for gaming
21. Interactive learning kit with touch sensor.
22. Google voice recognition assisted remote control robot.
23. Learn electronics the smart way – TROPS and Beak kit

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Develop a real time projects using embedded systems including 8051 and Advanced RISC Machines (ARM).
2. Design IoT based products that can be used in all real time applications.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	2	-	2	-	-	-	-	-	-
CO2	-	3	3	1	3	1	-	2	-	-	-
CO3	2	2	-	-	-	-	-	2	-	2	-

23CSCSTS27	INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT	L	T	P	C
		0	2	2	2
*Note: * Students should be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break*					

Course Objectives:

- To expose the students to understand technical and professional skill requirements in IT industries.
- To impart professional skills for solving problems in industries.
- To train the students to design innovative solutions for a problem.
- To motivate the students to become an Entrepreneur.
- To develop communication and technical report writing skill.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of second semester for Full Time / Fifth semester for Part – Time) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the third semester for Full Time / Fifth semester for Part – Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

For seminar/mini project, the students will work for two periods per week guided by a faculty. They will be asked to give a presentation of not less than 15 minutes and not more than 30 minutes (on any technical topic for seminar and on the project title for mini project). They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the examiners based on the technical presentation, the report and also on the interaction shown during the seminar/viva for seminar and mini project respectively.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the day-to-day job in IT industries, and technical and professional skills needed for an industry.
2. Develop and refine technical and professional skills through hands-on work experience.
3. Design an innovative solution for an Industry requirement by applying the knowledge learned from industry and in academics.
4. Develop a startup for product or services based on the people or industry requirements.

5. Communicate effectively the knowledge learned in internship through document and PowerPoint presentation.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	3	-	-	-
CO3	1	-	2	1	2	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	1	2	-	2
CO5	1	-	-	-	2	-	-	-	-	3	-

23CSCSPV33	**PROJECT WORK AND VIVA-VOCE PHASE-I**	**L**	**T**	**P**	**C**
		0	16	4	10

Course Objectives:

- To inculcate the ability of the student to solve specific problems right from its identification.
- To review literatures based on the problem statement.
- To label methodology for solving the problem.
- To solve problems using modern tools if required.
- To impart the students in preparing project reports and to defend their reports during evaluation.

The students will individually undertake a research problem in the field of Computer Science and Engineering in the third semester for Full-Time / Fifth semester for Part-Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Third semester for Full-Time / Fifth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand and articulate problem statement and identify the objectives of the project.

2. Review the state-of-the-art literature on the topic of the proposed work.
3. Design the methodology of the work in terms of block diagram.
4. Design experiments and conduct investigations of the work using modern IT tools and infer the results in graph, table and charts.
5. Communicate effectively through technical report and PowerPoint presentation.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	3	-	-	-	-	-	-	3	-	3
CO2	1	2	-	-	-	-	-	3	3	-	3
CO3	1	-	2	-	-	-	-	-	3	-	3
CO4	1	-	2	2	2	-	-	-	3	-	3
CO5	1	-	-	-	-	-	-	3	3	3	3

23CSCSPV41	**PROJECT WORK AND VIVA-VOCE PHASE-II**	**L**	**T**	**P**	**C**
		0	24	6	15

Course Objectives:

- To inculcate the ability of the student to solve specific problems right from its identification.
- To review literatures based on the problem statement.
- To label methodology for solving the problem.
- To solve problems using modern tools if required.
- To impart the students in preparing project reports and to defend their reports during evaluation.

The students will continue the research problem undertaken during fourth semester for Full-Time / Sixth semester for Part-Time in the field of Computer Science and Engineering. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Fourth semester for Full-Time / Sixth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand and articulate problem statement and identify the objectives of the project.
2. Review the state-of-the-art literature on the topic of the proposed work.
3. Design the methodology of the work in terms of block diagram.
4. Design experiments and conduct investigations of the work using modern IT tools and infer the results in graph, table and charts.
5. Communicate effectively through technical report and PowerPoint presentation.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	3	-	-	-	-	-	-	3	-	3
CO2	1	2	-	-	-	-	-	3	3	-	3
CO3	1	-	2	-	-	-	-	-	3	-	3
CO4	1	-	2	2	2	-	-	-	3	-	3
CO5	1	-	-	-	-	-	-	3	3	3	3

\

PROGRAM ELECTIVES

23CSCSPEXX	WIRELESS AND MOBILE NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basics of wireless networking and impart knowledge about MAC and spread spectrum technologies and Challenges in wireless environment.
- To familiarize with the concepts of IEEE 802.11 standards, architectures, protocols and WLAN deployment issues.
- To educate about wireless cellular networks generations, channel assignment and handoff strategies and teach about the performance of coverage and capacity in cellular systems.
- To make the students to understand the concepts of IEEE 802.21, IEEE 802.22 and Tiny OS.
- To impart the knowledge on Wireless PANS, vehicular adhoc networks and security aspects of wireless networking

Introduction: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy

Wireless local area networks: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

Wireless cellular networks: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless 10 Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, Overview on IEEE 802.21 Media Independent Handover. Wireless sensor networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Overview on Tiny OS.

Wireless pans: Bluetooth AND Zigbee, Introduction to Wireless Sensors. Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication. Advanced topics: IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.

References:

1. Jochen Schiller, "Mobile Communications", 2nd edition, Pearson, 2004.2.
2. William Stallings, "Wireless Communications and Networks", Pearson Education India, 2009
3. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc, 2003
4. Yi Bing Lin and ImrichChlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc, 2008
5. Pandya Raj, "Mobile and Personal Communications Systems and Services", Wiley-IEEE Press, 2004

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Explain the basics of wireless networking, MAC and spread spectrum technologies.
2. Analyze the fundamental issues in hidden and exposed terminal problems, fading effects in WLAN deployment.
3. Familiar with wireless cellular networks generations, channel assignment and handoff strategies.
4. Understand the building blocks of IEEE 802.21, IEEE 802.22 and Tiny OS.
5. Explain the need for Wireless PANS, vehicular adhoc networks with demanding security features.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	1	3	2	-	-	-	-	-	-	-
CO4	3	1	3	2	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-

23CSCSPEXX	**COMPUTER VISION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To educate the basics of Image processing system and image filtering techniques.
- To provide knowledge about binary shape analysis and object labelling methods.

- To impart knowledge about pattern matching and object location models.
- To make the students to understand various aspects of 3-D vision model.
- To make the students familiar with both the theoretical and practical aspects of real time pattern recognition systems

Nature of Vision – Images and imaging operations: Introduction – Image processing operations – Basic image filtering operations: Noise suppression by Gaussian smoothing – Median filters – Color in image filtering – Corner and interest point detection.

Binary shape analysis: connectedness – Object labelling – Size filtering – Distance functions – Skelton and thinning. Boundary pattern analysis: Boundary tracking – Centroidal profiles – Occlusion problems.

Pattern matching techniques: Graph-theoretic approach to object location, possibilities for saving computation, Using generalized Hough transform for feature collation, generalizing the maximal Clique and other approaches, relational descriptors, Search.

3D - Vision and variety of methods – Shape and shading – Photometric stereo – Shape and texture. Motion: Introduction, Optical Flow, Interpretation of optical flow fields, using focus of expansion to avoid collision, time-to-adjacency analysis, difficulties with optical flow method, stereo from motion, Kalman filter.

Real-time pattern recognition systems: Case study on location of cereals and insects, Surveillance, In-Vehicle vision systems.

References:

1. Hearn D and Baker M.P., “Computer Graphics”, Second Edition, PHI, 1998.
2. E. R. Davies, “Computer and Machine Vision: Theory, Algorithms, Practicalities”, Fourth edition, Academic Press, 2012.
3. Foley J.D., Vandam A., Feiner SK., Hughes JF., “Computer Graphics Principles and Practice”, Addison-Wesley Publishing Company, 1993.
4. David A. Forsyth, Jean Ponce, “ Computer vision: A Modern Approach”,2nd Edition, Pearson, 2012.
5. Bernd Jahne, Horst HauBecker, “Computer Vision and Applications: A Guide for Student and Practitioners”, Academic Press, 2000

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand and capable of using images with various filters.
2. Design and analysis of shape and boundary descriptors in images.

3. Design and analysis of pattern matching and various transform techniques.
4. Analyze and apply design 2-D strategies to 3-D vision models.
5. Develop the real time pattern recognition projects from concepts of image and video processing.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	-	-	-	-	-	-	-	-	-
CO2	1	2	2	1	-	-	-	-	-	-	-
CO3	1	2	2	1	-	-	-	-	-	-	-
CO4	1	2	1	-	-	-	-	-	-	-	-
CO5	1	2	1	1	-	-	-	-	1	-	-

23CSCSPEXX	**ADVANCED IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of digital image processing and elements of visual perception.
- To demonstrate the concepts of enhancement in spatial and frequency domain.
- To impart knowledge on various transforms and color image processing.
- To explain the concepts on image degradation/ restoration process.
- To illustrate the concepts of image compression, segmentation, representation and description methods.

Digital image representation Fundamental Steps in Digital Image Processing, Components of an Image Processing System-Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels.

Image enhancement : Spatial Domain – Gray level Transformations – Histogram Processing – Smoothing and Sharpening filters. Frequency Domain - Filtering in Frequency Domain — Smoothing and Sharpening filters – Homomorphic Filtering

2-D Fourier transform, Fast Fourier transform, Other separable transforms: Walsh Transform, Hadamard Transform, Discrete Cosine Transform, wavelet Transform, Haar function, Gabor Transform, Hotelling transforms, Color Fundamentals. Color Models. Basics of Color Image Processing.
A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering. Inverse Filtering. Minimum Mean Square Error (Wiener) Filtering. Constrained Least Squares Filtering. Geometric Mean Filter.

Image compression: Redundancies, image compression models, elements of information theory, error-free compression variable length coding, bit plane coding, lossless predictive coding, lossy compression, predictive coding, transform coding, image compression standards- JPEG, MPEG. Image Analysis: Segmentation, detection of discontinuities, edge linking and boundary detection, Edge Operators, thresholding, region-oriented segmentation. Image Representation and Description: Representation schemes, Boundary descriptors, Regional descriptors.

References:

1. R.C. Gonzalez and R. E. Woods, Digital image processing, Addison-Wesley Publishing House, 3rd edition, 2008.
2. A. K. Jain, Fundamentals of digital image processing, Prince-Hall India, 1988
3. K. R. Castleman, Digital Image Processing, Prince-Hall International, 1996
4. A.L.Bovik, Handbook of Image and Video Processing, Academic Press, 2nd edition, 2005
5. Yao Wang, JoernOstermann, Ya-Qin Zhang, Video Processing in Communication, Prentice Hall, Pearson Education, 2002.
6. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Prentice Hall, Pearson Education, 2004.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the fundamental concepts of digital image processing and elements of visual perception.
2. Apply image enhancement techniques in spatial and frequency domain.
3. Implement various transform methods used in real time applications and basics of color image processing.
4. Build models for image degradation and restoration process including spatial, inverse and wiener filters.
5. Design and evaluate algorithms based on image compression, segmentation, representation and description.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-	-	-	-
CO5	2	2	2	1	-	-	-	1	1	-	-

23CSCSPEXX	**WIRELESS SENSOR NETWORKS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To provide basic of Wireless Sensor Networks.
- To familiarize with various protocols at various layers.
- To impart knowledge on data dissemination protocols and model links cost.
- To enhance performance of sensor networks and to identify bottlenecks.
- To familiarize with sensor networks for various application setups.

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors. Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture.

Hardware Platforms: Motes, Hardware parameters. Introduction to NS-3: Introduction to Network Simulator 3 (NS-3), Description of the NS-3 core module and simulation example.

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled. Introduction to Markov Chain: Discrete time Markov Chain properties, classification and analysis. MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC (Markov Chain).

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution . Routing protocols: Introduction, MANET protocols Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast.

Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain). Advanced topics in wireless sensor networks. Advanced topics: Recent development in WSN standards, software applications.

References:

1. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley 2010.
2. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks: Technology, Protocols and Applications", John wiley& sons Inc., 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", Springer 2010.
4. KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks -Technology, Protocols, and Applications", Wiley Inderscience 2007.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the basic concepts of layered design in Wireless Sensor Networks.
2. Recognize how to transfer data in Wireless Sensor Networks.
3. Identify the different MAC Protocol useful for Wireless Sensor Networks.
4. Construct various security related issues in routing protocols.
5. Build the knowledge in relevant advanced topics in Wireless Sensor Networks.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	2	-	-	-
CO5	1	-	1	-	1	-	-	-	1		-

23CSCSPEXX	KNOWLEDGE BASED SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To teach the biological foundations of intelligent systems such as ANN, BPN, RBF and recurrent networks.
- To explain fuzzy logic, genetic algorithm and fuzzy neural network algorithms.
- To demonstrate the basic concepts of search techniques, heuristic search and optimization methods.
- To describe the knowledge representation issues, formal logic and black board architectures.
- To develop the skills required to solve the uncertainty problems using uncertainty reasoning approaches and evolutionary algorithms.

Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation.

References:

1. Luger G.F. and Stubblefield W.A., “Artificial Intelligence: Structures and strategies for Complex Problem Solving”, Addison Wesley, 6th edition, 2008.
2. Russell S. and Norvig P, Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition, 2009.

3. RajendraAkerkar, PritiSajja, "Knowledge based Systems", John Barlett Learning, 2010.
4. Steven Finlay, "Artificial Intelligence and Machine Learning for Business", Relativistic, 2017.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Build intelligent systems using ANN, BPN, RBF and recurrent networks for solving problems.
2. Understand fuzzy logic, genetic algorithm and fuzzy neural network algorithms and to apply them appropriately.
3. Evaluate search techniques, heuristic search approach and optimization methods in searching for a solution in problem solving.
4. Design the knowledge representation using formal logic and structured representation for symbolic reasoning and logical inference.
5. Analyse the uncertainty reasoning approaches and evolutionary algorithms for solving uncertainty problems.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	1	1	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

23CSCSPEXX	**DISTRIBUTED SYSTEMS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts of distributed data processing and DBMS architecture.
- To explain about the distributed database strategies and query processing issues.
- To teach the factors of query optimization and transaction concepts.
- To identify the reliability issues and failures in DDBS.

- To impart the knowledge to large volume of shared data in a parallel and distributed environment.

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts. Distributed database management system Architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

Distributed database design: Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. Semantics data control: View management; Data security; Semantic Integrity Control. Query processing issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

Distributed query optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms. Transaction management: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models. Concurrency control: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

Parallel database systems: Parallel architectures; parallel query processing and optimization; load balancing. Advanced topics: Mobile Databases, Distributed Object Management, Multi-databases.

References:

1. M.T. Ozsu and P. Valduriez, “Principles of Distributed Database Systems” , Prentice- Hall, 1991.
2. Bell and J. Grimson, “ Distributed Database Systems”, Addison-Wesley, 1992.
3. Chanda Ray, “Distributed Database Systems”, Pearson Education India, 2009.
4. George coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, “Distributed Systems Concepts and Design”, 5th edition, Addison Wesley, 2012

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the distributed data systems and DBMS.
2. Build the distributed database design and Query processing.

3. Analyze the transaction management and concurrency control in DDBs.
4. Describe with various reliability techniques in DDBS.
5. Develop the distributed computing environment and parallel architecture techniques.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	2	-	-	-	-	-	-	-	-	-
CO2	1	2	1	1	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-
CO4	1	2	1	-	-	-	-	-	-	-	-
CO5	1	2	1	1	-	-	-	-	-	-	-

23CSCSPEXX	**WEB ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To impart the knowledge about web engineering principles for web application development and requirement specifics in Web Engineering.
- To familiarize the web application architectures and learn how to Modeling the web applications.
- To disseminate the knowledge on web application design.
- To expose Testing Web applications by testing fundamentals test schemes and test methods.
- To develop the skills required to promote web applications and web project management.

Introduction to Web Engineering: Web Engineering — Motivation -– Categories of Web Applications — Characteristics of Web Applications — Requirement Specifics in web engineering – Web engineering: Components; Process; Communication and Planning.

Web Application Architecture and Modelling Web Applications: Introduction – Categorizing architectures – Specifics of Web application architectures – Components of generic web application architecture -– Layered and Data-aspect architectures – Modelling specifics in web engineering— Modelling: Requirements; Content; Hypertext; Presentation and Customization – Modelling Frameworks – Modelling Languages – Analysis modelling of web apps: Content; Interaction and Configuration models.

Web Application Design: Design for web apps – Goals – Design Process – Interactive Design: Principles and Guidelines; Workflow; Preliminaries; Design Steps; Usability and Issues – Design: Information; Navigation; Functional and Presentation.

Testing Web Applications: Testing fundamentals -– Test specifics in Web Engineering -– Test Approaches -– Testing web Apps – Test schemes -– Test methods and techniques — Test automation.

Promoting Web Applications and web project management: Operation and maintenance of web applications: Introduction; Challenges in launching the web application. Promoting web application; Content Management. Usage Analysis –Web project management – Usability of web application – Performance of web application.

References:

1. GertiKappel, Birgit Proll, “Web Engineering”, John Wiley and Sons Ltd, 2006
2. Roger S. Pressman, David Lowe, “Web Engineering”, Tata McGraw Hill Publication, 2007.
3. Gustavo Rossi, Oscar Pastor, Daniel Schwabe, Luis Olsina, “Web Engineering: Modelling and Implementing Web Applications”, Springer, 2007.
4. San Murugesan, Yogesh Deshpande, “Web Engineering: Managing Diversity and Complexity of Web Application Development”, Springer, 2001.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand web engineering concepts web application categories.
2. Build web application architecture and modeling for representing their requirements, content, hypertext, presentation and customization .
3. Apply design technique to develop web applications.
4. Compare various testing approaches in testing web applications.
5. Apply guidelines to manage web applications for promoting and monitoring web project management.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	-	-	-	-		-	-	-	-	-
CO2	-	1	1	-	-	1	-	-	-	-	-
CO3	2		1	-	-	1	-	1	-	-	-
CO4	1	1	1	-	-	-	-	-	-	-	-
CO5	2	1	1	-	1	-	-	1	1	-	-

23CSCSPEXX	**DATA PREPARATION AND ANALYSIS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of data description, and distribution.
- To familiarize with cleaning the data sets and preparing unstructured data.
- To illustrate various statistical methods used for data analysis.
- To demonstrate different data exploration techniques and visualization methods.

Introduction: Sources of data, process for making sense of data. Describing Data: Observations and variables, types of variables, central tendency, distribution of the data, confidence intervals, hypothesis tests.

Preparing data tables: Cleaning the data, removing observations and variables, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data.

Exploratory Analysis, Descriptive and comparative statistics, clustering and association, hypothesis generation. Identifying and understanding groups: Learning Decision Trees from Data.

Visualization, Designing visualizations, time series, geolocated data, correlations and connections, hierarchies and networks, interactivity. Understanding relationships: Visualizing Relationships Between Variables, Calculating Metrics About Relationships.

Building models from data: Overview, Linear Regression, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees, Ethics in the profession: Cases in computing, statistics and communication.

References:

1. Glenn J. Myatt, Wayne P. Johnson, "Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining", 2nd Edition, Wiley, 2014.
2. Edward R. Tufte, "The Visual display of Quantitative Information", 2nd Edition, Graphics Press Cheshire, 2001.
3. Ben Fry, "Visualizing Data: Exploring and Explaining Data with the Processing Environment", O'Reilly Media Inc., First Edition, 2007.
4. TamraparniDasu, Theodore Johnson, "Exploratory Data Mining and Data Cleaning", John Wiley & Sons Inc., Wiley Series in Probability and Statistics, 2003.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the process of describing the data and usage of various statistical analysis methods.
2. Identify the need for cleaning the data sets and applies statistical methods for preparing the data tables.
3. Analyze the data sets to summarize the characteristics using descriptive and comparative statistical approaches.
4. Apply data visualization techniques to identify the relationship among variables.
5. Design and Evaluate various classification and regression models used in real time applications of data analysis.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	1	-	-	-	-	-	-	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	2	-	-	-	-	-
CO5	3	2	2	-	2	2	-	-	1	-	-

23CSCSPEXX	SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basic phases of development of a secure Software Design
- To understand the major considerations for enterprise integration, deployment concepts of requirements engineering and Analysis Modeling.
- To learn Enterprise system administration for enhancing network services.
- To make a aware for requirements of enterprise network to handle multiple services.
- To develop an fault free network environment of an enterprise by handling exceptions in mobile secure applications.

Secure Software Design: Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application. Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in a 8 heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws. Case study of DNS server, DHCP configuration and SQL injection attack.

References:

1. Theodor Richardson, Charles N Thies, “Secure Software Design”, Jones & Bartlett, 2013..
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, “Enterprise Software Security: A Confluence of Disciplines”, Addison Wesley, 2014.

3. William R. Simpson, "Enterprise level security: Securing Information Systems in an Uncertain world", 1st edition, CRC Press, 2016.
4. Qing Li, Gregory Clark, "Security Intelligence : A Practitioner's Guide to Solving Enterprise Security Challenges", Wiley, 2010

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Build software secure system and perform security testing with quality assurance.
2. Design and build a database using an enterprise database system.
3. Design, implement and maintain a directory-based server infrastructure in heterogeneous system.
4. Ability to manage and troubleshoot a network running multiple services.
5. Design mobile application problems for software containing minimum vulnerabilities and flaws.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	2	-	-	-	-	-	-	-	-
CO2	1	1	2	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-
CO4	1	1	1	1	-	-	-	-	-	-	-
CO5	1	1	1	-	1	-	-	-	-	-	-

23CSCSPEXX	**GRAPHICS PROCESSING UNIT (GPU) COMPUTING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basics of parallel programming with Graphics Processing Units(GPUs).
- To make the students to learn Memory hierarchy, pointers and arrays.
- To provide in-depth Knowledge and understanding about Synchronization and Functions.
- To develop the skills required to Debugging GPU programs.
- To illustrate the concept of Deep Learning and Multi-GPU processing with case studies.

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning. Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.

References:

1. David Kirk, Wen-meiHwu, “Programming Massively Parallel Processors: A Hands-on Approach”, 2nd edition, Morgan Kaufman, 2012.
2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufman; 2013.
3. Cai, Yiyu, See, Simon (Eds), “GPU Computing and Applications, Springer, 2015.
4. Jason Sanders, Edward Kandrot, “CUDA By Example: An Introduction to General Purpose GPU Programming”, Addison Wesley, 2011

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Implement the concepts in parallel programming.
2. Understand the basic concepts and solve problems involving Memory allocation, Pointers and Arrays.
3. Recognize the CPU and GPU Functions.

4. Solve Debugging and profiling parallel programs.
5. Evaluate the case studies in image processing and can identify the issues related to Dynamic Parallelism and Heterogeneous processing.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	-	1	-	-	-	-	-	-	-	-
CO2	2	1	2	1	-	-	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-
CO5	2	2	1	1	-	-	-	-	1	-	-

23CSCSPEXX	**DIGITAL FORENSICS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the concepts an in-depth study of the rapidly changing and fascinating field of computer forensics.
- To combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- To impart knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
- To collect and preserve E-evidence, investigate operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

References:

1. John Sammons, "The Basics of Digital Forensics", 2nd edition, Syngress,2014.
2. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", 2nd edition, Charles River Media,2005.
3. Cory Altheide, Harlan Carvey, "Digital Forensics with Open Source Tools", Elsevier, 2011.
4. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensicsand Investigations, 4th Edition, Course Technology,2010.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand relevant legislation and codes of ethics.
2. Develop computer forensics, digital detective and various processes.
3. Apply policies and procedures in E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Design web forensics and network forensics.
5. Analyze the legal aspects of digital forensics

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-
CO3	1	-		1	-	-	-	-	-	-	-
CO4	2	1	1	1	-	1	-	1	-	-	-
CO5	3	-	1	-	-	1	-	1	-	-	-

23CSCSPEXX	**MOBILE APPLICATIONS AND SERVICES**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basics of mobile computing and impart knowledge about Generic User Interface, android development environment in developing a mobile application.
- To familiarize with the concepts of synchronizing, storing and retrieving of data with content providers.
- To educate about Mobile App wireless connectivity and teach about the performance and multithreading of mobile applications.
- To train about the packaging and deployment of location based mobile applications and explain about the mobile multimedia architecture.
- To impart knowledge on architecture, design, development of mobile application and security aspects of mobile computing techniques in IoT nodes involving agents.

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development AndroidUser.

More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs. Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony. Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

Putting It All Together : Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services. Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection,MobileAppDevelopmentHurdles,Testing,SecurityandHacking,ActiveTransactions, More on Security, Hacking Android Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.

References:

1. Wei-Meng Lee, “Beginning Android Application Development”, John Wiley & Sons, 2012.
2. Asoke K. Talukder, Roopa R. Yavagal, “Mobile Computing: Technology, Applications, and Service Creation”, McGraw-Hill Communications Engineering,2007.
3. Devi Kamal, “Mobile Computing”, 2nd edition, Oxford University Press,2012.
4. Mahesh Panhale, “Beginning Hybrid Mobile Application Development”, Prèss,2016.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Build a simple mobile application involving Generic User Interface with the knowledge of mobile computing.
2. Develop applications to synchronize, store and retrieve the data with content providers using User Interfaces.
3. Design Mobile Applications to analyze the multithreaded concepts and predict its performance over mobile connectivity.
4. Understand the procedure in packaging and deployment for location based mobile applications.
5. Create new designs and develop mobile applications for evolving architecture supporting IoT nodes with demanding security features.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	-	2	-	1	-	-	-	-	-	-
CO2	2	-	2	1	-	-	-	-	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	2	-	-	-	-
CO5	1	2	3	2	1	1	-	-	2	-	-

23CSCSPEXX	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To provide insight to the mathematical formulation of real world problems.
- To understand the need and origin of the optimization methods.
- To explain mathematical problems using nature based algorithms especially for NP- Hard problems.
- To impart skills on various applications of optimization methods used in engineering.

Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Real life Problems and their mathematical formulation as standard programming problems.

Recent trends: Applications of ant colony optimization, genetics, linear and quadratic programming in real world applications.

References:

1. Laurence A. Wolsey, "Integer programming", Wiley,1998.
2. Antoniou, Andreas, Lu, Wu-Sheng, "Practical Optimization: Algorithms and Engineering Applications, Springer,2007.
3. Edwin K. P. Chong, Stanislaw H. Zak, "An Introduction to Optimization", 4th edition, Wiley,2013.
4. Dimitris Bertsimas, Robert Weismantel, "Optimization over integers", Dynamic Ideas Publishers,2005.
5. John K. Karlof, "Integer Programming: Theory and Practice", CRC Press,2005.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the engineering applications of optimization problems..
2. Apply the concept of optimality criteria for various types of optimization problems.
3. Solve various constrained and unconstrained problems in Single variable as well as multivariable.
4. Evaluate and measure the performance of an algorithm.
5. Investigate, study, develop and organise innovative solutions for various applications

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-
CO3	1	2	1	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	-
CO5	1	2	1	1	-	-	-	-	-	-	-

23CSCSPEXX	DATA MINING AND WAREHOUSING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basics of Data mining principles and techniques.
- To make the students to study the overview of Visualization and Statistical Perspectives and clustering techniques in details for better organization and retrieval of data.
- To explain the concept of Predictive Modelling for retrieval purposes.
- To expose the concepts of Data warehousing Architecture and Implementation.
- To develop the skills required for Business applications and Tools of Data mining.

Introduction - Relation to statistics, databases, machine learning – Taxonomy of data mining tasks – Steps in data mining process – Overview of data mining techniques.

Visualization and Statistical Perspectives - Visualization – Dimension reduction techniques – Data summarization methods – Statistical perspective – Probabilistic – Deterministic models – Clustering Regression analysis – Time series analysis – Bayesian learning.

Predictive Modelling - Classification – Decision trees – Patterns – Association rules – Algorithms, Applications – Tools – Case studies.

Planning the Data warehouse – Fundamentals of data warehousing – Review of Applications – Managing the Data warehouse Project – Integrating data – Infrastructure – Architecture – Technology – metadata management – Data Quality.

Exploiting the data - Data warehouse Applications – Data Access and Exploitation – Looking to the Future – Next Generation Data warehouse – Future Directions in the First Generation of Data warehouse – Second Generation of Data warehouse – Applications - Tools.

References:

1. Usama M.Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, “Advances in Knowledge Discovery and Data Mining”, The MIT Press, 1996.
2. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers,2000.
3. Ralph Kimball, “The Data Warehouse Life Cycle Toolkit”, John Wiley & Sons Inc., 1998.
4. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Third edition, (Then Morgan Kufmann series in Data Management systems),2011.
5. Sean Kelly, “Data Warehousing in Action”, John Wiley & Sons Inc.,1997.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand about the fundamentals of data mining.
2. Describe the knowledge imbibed in the high dimensional system.
3. Analyze the high dimensional data for better organization of the data, algorithms, applications, tools and case studies.
4. Construct the plan for data ware housing and mining, review of applications and managing the data warehouse Projects.
5. Evaluate the various mining applications and tools.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	1	-	-	1	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-
CO5	3	1	-	-	1	-	-	1	-	-	-

23CSCSPEXX	**SPEECH AND AUDIO SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basic mechanism of speech production and auditory perception.
- To teach the students the basic concepts of time and frequency domain analysis of speech signal.
- To explain the various parametric representation of speech.
- To educate about several applications of speech and audio processing.

Speech production: Mechanism of speech production, Acoustic phonetics - Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM - Auditory perception: psycho acoustics.

Time domain analysis of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function.

Frequency domain analysis: Sampling rates – Filter banks - Spectrogram - Pitch and formant extraction - Homomorphic speech processing : Cepstral analysis of Speech, Formant and Pitch Estimation, Audio compression methods and standards, Chroma features, PNCC, LSF, LAR, Sonogram, Tempogram.

Parametric representation of speech : Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP - PLP and MFCC Coefficients.

Case study: Automatic speech recognition – Text dependent and text independent speaker identification and verification – Speech synthesis – Audio segmentation – Music classification and information retrieval – Music emotion recognition.

References:

1. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", Prentice Hall, 1979.
2. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition,2006.
3. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education,2004.
4. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education,2003.
5. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education,2002.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Define speech production mechanism and auditory perception.
2. Analyze and make use of time domain features in speech and audio processing.
3. Solve real time problems using frequency domain analysis of speech signal.
4. Elaborate on the parametric representation of speech.
5. Design and develop systems for various applications of speech processing using Open Source Programming tools.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-
CO5	2	2	2	2	2	-	-	-	1	-	-

23CSCSPEXX	**NETWORK AND INFORMATION SECURITY**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of network and information security.
- To impart knowledge about classical cryptography, Block ciphers, MAC and AES.
- To provide basic knowledge of Number theory, Public key cryptography, Digital Signature, the basic concepts of Key management and public key infrastructure (PKI).
- To analyze the MAC algorithms and internet security protocols.
- To explain about Intrusion detection, Virus and Firewalls.

An Overview of Computer Security-Security Services-Security Mechanisms-Security Attacks-Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES Modes of Operation- AES-Linear Cryptanalysis, Differential Cryptanalysis- Hash Function - SHA 512-Message Authentication Codes-HMAC - Authentication Protocols.

Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer- Attacks on RSA-The ELGamal Cryptosystem- Digital Signature Algorithm-Finite Fields-Elliptic Curves Cryptography- Key management – Session and Interchange keys, Key exchange and generation-PKI.

Authentication requirements and functions, MAC and Hash Functions, MAC Algorithms: Secure Hash Algorithm, Whirlpool, HMAC. MD5 MAC, SHA Internet Security Protocol: SSL, SHTPD SET, 3D Protocol.

Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

References:

1. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education,2006.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, 2nd Edition,2010.
3. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security", Cengage brain, 4th Edition, 2012.
4. Bernard L. Memezes, "Network Security and Cryptography", Course Technology, 2012.
5. Jason Andress, "The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice", Elsevier,2011.
6. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC,2006.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the basic concepts in network and information security.
2. Apply the techniques including classical cryptography, Block ciphers, MAC and AES.
3. Design algorithms using Public key cryptography and implement Key management.
4. Determine authentication requirements and functions using MAC algorithms and internet security protocols.
5. Explain the basic concepts of Intrusion detection, Virus and Firewall.

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	--	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-
CO5	2	-	2	-	1	-	-	-	-	-	-

23CSCSPEXX	DIGITAL VIDEO PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce basic concepts of digital video, analog video and digital video standards.
- To illustrate the concept of 2D and 3D motion estimation with popular algorithms.
- To impart knowledge on various techniques of image segmentation.
- To provide details about video enhancement in spatial and frequency domain.
- To explain the basic concepts of video compression approaches and video compression standard.

Human Visual System and Color: Color Vision and Models - Contrast Sensitivity -Spatio-Temporal Frequency Response - Stereo/Depth Perception. Analog Video: Progressive vs. Interlaced Scanning-Analog-Video Signal Formats -Analog-to-Digital Conversion. Digital Video: Spatial Resolution and Frame Rate - Color, Dynamic Range, and Bit-Depth. Digital- Video Standards: 3D Video - 3D-Display Technologies - Stereoscopic Video - Multi-View Video. Digital-Video Applications.

Motion models : Estimation Criteria- 2D Apparent-Motion Estimation: Sparse Correspondence - Optical-Flow Estimation - Optical-Flow Equation and Normal Flow-Displaced Frame Difference. Motion Estimation algorithms: Global motion estimation-Block matching-Variable- Size Block-Matching - Hierarchical Block-Matching -Phase-Correlation Method. 3D Motion and Structure Estimation: Camera Calibration- Affine Reconstruction- Projective Reconstruction- Euclidean Reconstruction.

Image Segmentation: Thresholding - Clustering - Bayesian Methods - Graph-Based Methods - Active-Contour Models. Change Detection: Shot-Boundary Detection- Background Subtraction. Motion Segmentation: Dominant-Motion Segmentation- Multiple-Motion Segmentation. Motion Tracking: Graph-Based Spatio-Temporal Segmentation and Tracking- Kanade Lucas Tomasi Tracking -Mean-Shift Tracking - Active-Contour Tracking- 2D mesh Tracking.

Theory of Spatio-Temporal Filtering: Frequency Spectrum of Video- Motion-Adaptive Filtering -Motion-Compensated Filtering. Video-Format Conversion: Down-Conversion- De-Interlacing - Frame-Rate Conversion. Multi-Frame Noise Filtering: Motion-Adaptive Noise Filtering- Motion-Compensated Noise Filtering. Multi-Frame Restoration: Multi-Frame Modeling- Multi- Frame Wiener Restoration.

Video-Compression Approaches: Intra-Frame Compression, Motion JPEG 2000 and Digital Cinema- 3D Transform Coding - Motion-Compensated Transform Coding. Early Video Compression Standards: ISO and ITU Standards- MPEG-1 Standard- MPEG-2 Standard-8.3 MPEG-4 AVC/ITU-T H.264 Standard: Input-Video Formats and Data Structure-IntraPrediction -Motion Compensation. High-Efficiency Video-Coding (HEVC) Standard: Video-Input Format and Data Structure – Coding Tree Units.

References:

1. Murat Tekalp A, “Digital Video Processing”, Second Edition, Prentice Hall, 1995.
2. Bovik AL, “The Essential Guide to Video Processing”, Academic Press,2009.
3. Iain E. G. Richardson, “Video Codec Design”, John Wiley and Sons,2002.
4. Iain E. G. Richardson, “H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia”, Wiley,2003.
5. Bovik AL, “Handbook of Image and Video Processing”, second edition, Academic Press, 2005.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand fundamentals of digital video processing and capable of using MATLAB tools.
2. Analyze 2D and 3D motion estimation with popular algorithms
3. Evaluate algorithms based on image segmentation methods.
4. Apply video enhancement techniques in spatial and frequency domains.
5. Design more advanced video compression approaches and Video compression standards.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	2	-	-	-	-	-	-
CO2	1	2	1	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-
CO4	1	1	1	1		-	-	-	-	-	-
CO5	1	1	1	1	1	-	-	1	1	-	-

23CSCSPEXX	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

- To study the history of different medical imaging modalities.
- To introduce basic concepts on acquiring, storing and processing of medical images.
- To impart knowledge on visualization of medical images.
- To provide details about different image segmentation and multimodal medical image registration techniques.
- To understand functional imaging modalities including SPECT, PET and ultrasound.

Introduction to medical imaging technology, systems, and modalities. Brief history, importance, applications, trends, challenges. Medical Image Formation Principles: X-Ray physics, X-Ray generation, attenuation, scattering, dose Basic principles of CT, reconstruction methods, artifacts, CT hardware.

Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS), Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics, filtering, histogram modeling.

Medical Image Visualization Fundamentals of visualization, surface and volume rendering/visualization, animation, interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, spin physics, NMR spectroscopy, imaging principles and hardware, image artifacts.

Medical Image Segmentation - Histogram-based methods, Region growing and watersheds, Markov Random Field models, active contours, model-based segmentation. Multi-scale segmentation, semi-automated methods, clustering-based methods, classification-based methods, atlas-guided approaches, multi-model segmentation. Medical Image Registration Intensity-based methods, cost functions, optimization techniques.

PET and SPECT Ultrasound Imaging methods, mathematical principles, resolution, noise effect, 3D imaging, positron emission tomography, single photon emission tomography, ultrasound imaging, applications. Medical Image Search and Retrieval Current technology in medical image search, content-based image retrieval, new trends: ontologies. Applications. Other Applications of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy; Computer Aided Diagnosis/Diagnostic Support Systems.

References:

1. Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, Cambridge University Press,2009.
2. J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging: Medical Image Processing and Analysis", volume 2, SPIE Publications,2009.
3. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press,2005.
4. Geoff Dougherty, "Digital Image Processing for Medical Applications", First Edition, Cambridge University Press,2009.
5. Jerry L.Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition, Prentice Hall, 2005.
6. John L. Semmlow, "Biosignal and Medical Image Processing", Second Edition, CRC Press,2008.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand about the history of different medical image modalities.
2. Attain knowledge on different medical image acquisition, enhancement and storing methods.
3. Apply various image processing tools to segment and visualize medical images.
4. Extract models and analyze informations through image registration in order to help diagnosis, treatment and monitoring of diseases.
5. Develop Computer Aided Diagnosis Systems and Decision support systems based on different medical imaging techniques.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	1	-	-	-	-	-	-
CO4	2	1	2	1	1	-	-	-	-	-	-
CO5	2	2	3	1	-	-	-	-	-	-	1

23CSCSPEXX	MOBILE ADHOC NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To familiarize the fundamentals of adhoc Network architecture, MAC Protocols with classifications and issues.
- To disseminate the classifications of routing protocols and Multicast routing along with Layer Issues and also expose on TCP Over Ad Hoc and Sensor Network Architecture.
- To expose the data dissemination, gathering on MAC Protocols, Hybrid TDMA/FDMA and CSMA based MAC.
- To impart skills on Localization & QOS issues in WSN routing , OLSR, AODV and Localization in Sensor Network.
- To demonstrate the Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Heterogeneous Mesh Networks and Vehicular Mesh Networks.

ADHOC- Introduction – Issues in adhoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

AD-HOC Network routing & TCP– Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. adhoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, adhoc TCP, and SplitTCP.

WSN and MAC– Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

WSN Routing, Localization & QOS – Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network, Localization. QOS in WSN.

Mesh Networks– Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

References:

1. Marco Conti, Silvia Giordano , Ivan Ivan Stojmenovic Stefano Basagni , “Mobile Ad hoc Networking”, Wiley, SecondEdition,2015.
2. C.SivaRamMurthy and B.Smanoj, “Ad Hoc Wireless Networks– Architectures and Protocols”, Pearson Education,2006.

3. Perkins, “Ad hoc Networking”, Pearson Education,2008.
4. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers,2004.
5. C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education,2002.
6. Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Build the knowledge on adhoc Network architecture and classifications of MAC Protocols along with issues.
2. Implement Ad hoc routing protocols & Multicast routing and analyze the performances of Protocols.
3. Construct the MAC Protocols, Hybrid TDMA/FDMA and CSMA based MAC.
4. Design and implement the WSN routing, OLSR, AODV, Sensor Network and Mesh networks with MAC enhancements.
5. Evaluate the Mesh Networks, IEEE 802.11s Architecture, Heterogeneous Mesh Networks and Vehicular Mesh Networks.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	1	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-
CO5	2	2	1	1	-	-	-	-	-	-	-

23CSCSPEXX	**COMPUTER NETWORK ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the basics of network, layered approach and elementary data link protocol that makes design, implementation and operation of extensive networks possible.

- To familiarize with the concepts of switching, bridging, global addressing and virtual networks.
- To educate about routing and teach about the performance of routing protocols.
- To make the students to understand the concepts of end-to-end flow of information and congestion control.
- To impart the knowledge on electronic mail, HTTP, DNS and SNMP.

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop and-Wait , Sliding Window, Concurrent Logical Channels.

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP.

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP)

References:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach”,5th Edition, Elsevier,2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI,2014.
3. Uyless Black, “Computer Networks, Protocols, Standards and Interfaces”, 2nd Edition, PHI,2009.
4. Behrouz A Forouzan “TCP/IP Protocol Suite”, 4th Edition, Tata McGraw-Hill,2009.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Explain the basics of network, layered approach and elementary data link protocols.
2. Classify the devices, protocols and standards to design a network.
3. Construct and implement the concept of routing.
4. Evaluate the appropriate protocol and techniques related to transport layer in order to maintain consistent flow of information.
5. Describe the functions of electronic mail, HTTP, DNS and SNMP.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	1	2	1	-	-	-	-	1	-	-
CO4	3	1	1	1	-	-	-	-	-	-	-
CO5	2	1	-	-	-	1	-	-	-	-	-

OPEN ELECTIVES

23CSCSOEXX	DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the core concepts and technologies of data science.
- To familiarize about data collection and storage management system
- To impart the knowledge of statistical methods and distribution models
- To illustrate the concepts of data mapping variables in encoding.
- To develop the recent trends in various data collections using Python

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Applications of Data Science, Technologies for visualisation, Bokeh (Python). Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

References:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science, Straight Talk From The Frontline", O'Reilly Media Inc,2013.
2. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman. "Mining of Massive Datasets", Cambridge University Press,2014.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'ReillyMedia, 2015.
4. Cathy O'Neil, Rachel Schutt, "Doing Data Science", O'Reilly Media,2013.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Explain the data science process and various tool kits associated.
2. understand the fundamentals of data collection, management and storage for data science.
3. Analyze and evaluate statistical and classification model in data science using any advanced tools.
4. Describe data visualization techniques and data encodings.
5. Build the suitable application development in data science.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	1	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-
CO3	1	2	1	1	1	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	2	2	1	1	-	-	-	-	-	-	-

23CSCSOEXX	**INTERNET OF THINGS (IoT)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To exposé the basics of Internet of Things.
- To provide in-depth knowledge about the management, design and development of IoT systems.
- To enable the students to build embedded systems using Raspberry Pi boards.
- To impart programming skills to develop applications using Arduino.
- To illustrate the usage of cloud storage and tools for developing real time applications of IoT and to introduce IoE.

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vsM2M.

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services.

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks.

Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for IoT – Data Analytics for IoT – Software & Management Tools for IoT. IoE – Overview – Architecture- Smart objects and LLNs-Secure mobility.

References:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press,2015.
2. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen 2: API Features and ArduinoProjects for Linux Programmers”, Apress,2014.
3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
4. CunoPfister,“GettingStartedwiththeInternetofThings”,MakerMediaInc,2011.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understand various designs, protocols, levels and technologies in IoT.
2. Analyze design methodologies of IoT and describe the development and management of IoT systems.
3. Build embedded systems using Raspberry Pi boards.
4. Design IoT applications using Arduino.
5. Develop real time applications of IoT with Cloud Storage using Google-cloud-IoT and to understand IoE.

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-
CO4	2	2	2	1	2	-	-	-	-	-	-
CO5	2	-	1	-	2	1	-	2	-	-	-

23CSCSOEXX	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of big data and its applications.
- To impart programming skills on Map Reduce processing technique using Hadoop.
- To train the concept of data handling with Pig, Hive and other Hadoop Ecosystem tools.
- To illustrate the concept of data analysis techniques.
- To familiarize simple programs and case studies on R programming.

Introduction to Big Data: Big Data and its importance – Characteristics – Big data analytics – Basic requirements – Big data applications – Map Reduce framework – Algorithms using map reduce. NoSQL Databases: Key-value databases – Column-family databases – Document databases – Graph databases.

Apache Hadoop : Introduction – System principle – Architecture – Hadoop distributed file system – Hadoop Map Reduce – YARN – Operation modes – Hadoop Installation – Cluster creation – Hadoop commands – HDFS commands – YARN commands – Map Reduce commands – Moving Data in and out of Hadoop – Hadoop programming.

Hadoop Ecosystem: Introduction to Pig – Installation – Execution – Pig Latin: Basics – Data types – Building blocks – Operators – Functions – Example Scripts. Introduction to Hive- Installing and Running Hive – Hive QL – Tables – Querying data – User defined functions – Partitioning – Joins – Simple projects. Overview of Spark, Zookeeper, and other Hadoop Ecosystem tools.

Data Analysis Techniques: Linear and logistic regression modeling – Naïve Baye's classifier – Support vector machine – Neural networks – Principal component analysis – Linear Discriminant Analysis – K Nearest Neighbour – Decision Trees – Fuzzy logic – Clustering Techniques : Hierarchical, agglomerative, and K–Means.

Introduction to R: R Installation – Basic statements of R – Importing and exporting data – Ordered and unordered factors – Arrays and matrices – Lists and data frames – Reading data from files – Data visualization – Probability distributions – Statistical models in R – Manipulating objects – Data Pre-processing – Feature selection – Clustering – Classification and regression. Case Studies: Social network analysis – Text analysis –Marketing analysis.

References:

1. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill,2012.
2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly,2012.
3. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc.,2012.
4. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley,2015.
5. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation,2012.
6. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R",2013.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the fundamentals of big data and its applications.
2. Implement MapReduce processing technique using Hadoop.
3. Apply Pig, Hive and other Hadoop Ecosystem tools to manage big data.
4. Build applications with suitable data analysis technique.
5. Solve simple data analysis problems using R programming.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	-	-	-	-	-	-	-
CO3	2	2	1	-	2	-	-	1	-	-	-
CO4	3	2	2	1	-	1	-	-	-	-	-
CO5	2	2	1	-	2	-	-	2	-	-	-

23CSCSOEXX	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concept of Evolution of Cloud Computing and its system models with examples of existing technology.
- To introduce the basics of Virtual Machines and its different architectures.
- To demonstrate Comprehensive Analysis of resource pool on different virtualization platforms.
- To develop the skills required to set up Hadoop Cluster and to work on Map Reduce.
- To understand the Architectural Design of Compute and Storage Clouds for Resource Management, Resource Provisioning, Platform Deployment and Risk cum Security Management of virtual machines.

Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public , Private and Hybrid Clouds – Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization.

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines –Desktop Virtualization – Application Virtualization – Work with AppV – Mobile OS for smart phones – Mobile Platform Virtualization – Collaborative Applications for Mobile platforms.

Map Reduce Hadoop Distributed File Systems – Hadoop I/O – Developing Map Reduce Applications – Working of Map Reduce – Types and Formats – Setting up Hadoop Cluster.

Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers,2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing:Implementation, Management, and Security", CRC Press,2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
4. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner‟s Guide”, McGraw-Hill Osborne Media, 2009.
5. Tom White, "Hadoop: The Definitive Guide", Yahoo Press,2012.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Recall the Evolution of Cloud Computing System Models for Distributed Cloud Computing Architectures with existing technologies.
2. Summarize the Basics of Virtual Machines Architectures and their virtualization.
3. Analyze Resource Pool by Constructing Testing Environment for different Virtualization technologies.
4. Build and Set up Hadoop Cluster for working on Map Reduce.
5. Determine the Architectural Design of Compute and Storage Clouds for resource provisioning, deployment and security challenges of virtual machines.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	1	-	-	-
CO4	3	2	2	1	2	-	-	1	1	-	-
CO5	3	2	2	1	-	-	-	1	1	-	-

23CSCSOEXX	ADVANCED WEB DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concepts of web design and its issues.
- To impart knowledge on client side and server side technologies.
- To teach three tier application using Model-View-Controller and software components using Enterprise JavaBeans.
- To understand the importance of java based security solutions
- To explain the concept of frameworks and Object Relationship Mapping along with its architecture.

Web Design Basics: Web Engineering and application development - Introduction - Challenges and role of web engineering - Web design methods - Design issues - OOWS model driven approach - OOHDM - UML based web Engineering - Designing Multichannel Web Application. Designing web application with web ML and Web Ratio - Semantic web Information System - Quality evaluation and experimental web Engineering - Measuring and evaluating web application - Needfor empirical Web engineering.

Client and Server Side Scripting: Web technology basics - HTML5 - Cascading Style Sheet - Client side scripting - Java script - Java script objects - XML basics - DOM - SAX - XSL - AJAX - RSS - Database connectivity - Server side scripting - Servlet - Servlet life cycle - Servlet based web application - JSP / PHP / ASP.NET - Case study.

Web Application Development: Three tier architecture - Working with model - View - Controller - JCP -J2EE - XML based APIs - Application servers - Presentation tier and EIS tier - Java Mail - JMS - Java transactions - JNDI - Java authentication and authorization services - Java cryptography.

Component Based Development: Service Tier and Data tier - EJB architecture - Session beans - Entity beans - Message driven beans - J2EE connector architecture - Web Services - J2EE Web Services - Patterns – Presentation, service tier and Data tier patterns - J2ME - J2ME application development.

Advanced Frameworks: Understanding Struts - MVC framework - Struts control flow - Building mode, view and controller component - Hibernate - Architecture - Understanding O/R mapping - Query language - Spring framework – Architecture - Case studies - Current trends.

References:

1. Thomas Erl, "Service Oriented Architecture, Concepts, Technology, and Design", Pearson, 2005.
2. Black book – Java Server Programming (J2EE 1.4), Dreamtech Press,2007.
3. Gustavo Rossi, Oscar Pastor, Daniel Schwabe , Luis Olsina, "Web Engineering Modelling and Implementing web Applications", Springer,2008.
4. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew "Java web Services Architecture", Elsevier,2003.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of Web design and develop web applications using various models.
2. Develop Web applications using HTML and scripting technologies with advanced features.
3. Acquire knowledge of security features supported in Java.
4. Design web services using J2EE and related technologies.
5. Implement advanced frameworks, MVC frameworks and spring frameworks.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	2	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	1	-	-	1	-	-
CO5	1	-	-		-	-	-	1	-	-	-

23CSCSOEXX	**HUMAN AND COMPUTER INTERACTION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To impart knowledge on the fundamentals of Human Computer Interaction(HCI).
- To disseminate the knowledge on interaction design basics and HCI in software process.
- To describe important aspects of implementation of HCI and evaluation techniques.

- To illustrate concepts about Cognitive models, Linguistic models and Knowledge based analysis.
- To explain concepts about Ubiquitous computing application research.

The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices- Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction.

Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns.

Implementation support – Windowing system elements – using tool kits – user interface management ;Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user supportsystems

Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures; communication & collaboration models – Face-to-face communication – conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses.

Ubiquitous computing application research – virtual & augmented reality – information & data visualization; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.

References:

1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Pearson Education,2004.
2. John M.Carrol, “Human Computer Interaction in the New Millennium”, Pearson Education, 2002.
3. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: beyond human-computer interaction”, John-Wiley and Sons Inc.,2011.
4. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction”, Wiley,2010.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.

2. Describe the interaction design basics and design rules in HCI patterns.
3. Design an efficient and user friendly human computer interface by identifying various tools and techniques for interface analysis, design, and evaluation.
4. Analyze and implement cognitive models and knowledge based methods.
5. Identify and implement Ubiquitous computing applications and web technology based methods.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	1	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-		-	-
CO3	1	2	2	1	2	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-	-	-	-
CO5	2	1	1	-	1	-	-	1	1	-	-

23CSCSOEXX	**SOFT COMPUTING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of various soft computing frameworks including Artificial Neural Networks, fuzzy systems and evolutionary computation.
- To teach fuzzy sets, fuzzy relations, fuzzy membership functions, fuzzy inference and expert systems.
- To explain architecture, training and testing algorithms of different types of Artificial Neural Networks.
- To familiarize the students with different operations in genetic algorithms and applications of genetic algorithms in machine learning.
- To train the students with soft computing tool boxes in MATLAB and describe search and optimization techniques in soft computing.

Introduction to soft computing and neural networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Neural networks: Machine Learning Using Neural Network, Adaptive networks, feed forward networks, supervised learning neural networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

Genetic Algorithms: Simple GA, crossover and mutation, multi-objective Genetic algorithm (MOGA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, functions and files, study of neural network toolbox and fuzzy logic toolbox. Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

REFERENCES:

1. Jyh-Shing roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence”, Prentice Hall,2003.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Prentice Hall, 1st Edition,1995.
3. Timothy J.Ross, “Fuzzy Logic with Engineering applications”, Tata McGraw Hill, 3rdedition, 2010.
4. David E.Goldberg, “Genetic Algorithms in Search Optimization and Machine Learning”, Pearson Education,2007.
5. MATLAB Toolkit.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understand the basics of Artificial Neural Networks, classic sets & relations, fuzzy sets & relations and evolutionary computing techniques.
2. Determine membership functions to define the fuzziness in the fuzzy sets and to experiment the decision-making methods to achieve the problem goals.
3. Build Artificial Neural Network architectures, apply training and testing methods on networks and solve real world problems.
4. Implement and apply genetic algorithms to solve problems in the area of machine learning.
5. Develop applications using soft computing toolboxes in MATLAB and design optimization techniques using soft computing approaches.

Mapping of Course Outcomes with Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	-	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-
CO5	2	2	3	2	1	-	-	-	-	-	-

AUDIT COURSES I and II

23CSCSACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

Course Objectives:

- To understand how to improve your writing skills and level of readability.
- To learn about what to write in each section
- To understand the skills needed when writing a Title
- To ensure the good quality of paper at very first-time submission

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity andVagueness.

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

REFERENCES:

1. Goldbort R, " Writing for Science", Yale University Press (available on Google Books), 2006.
2. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
3. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book, 1998.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Plan and prepare paragraphs without ambiguity and vagueness.
2. Check plagiarism and paraphrasing.
3. Review the literatures and write a good discussion on any topic.
4. Utilize the knowledge obtained to write a good research paper.

23CSCSACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

Course Objectives:

- To understand the key concepts in disaster risk reduction and humanitarian response.
- To evaluate disaster risk reduction, humanitarian response policy and practice from multiple perspectives.
- To develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- To understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company,2007.
2. Sahni Pardeep, Alka Dhameja, Uma Medury, "Disaster Mitigation: Experiences and Reflections", PHI Learning Pvt. Ltd.,2001.
3. Goel S. L., "Disaster Administration And Management: Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd.,2008.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Demonstrate the significance of natural and man-made disasters.
2. Gain knowledge about disaster prone areas in India.
3. Understand post-disaster diseases/epidemics and their remedies.
4. Assess disaster risk and mitigation.

23CSCSACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- To Learn Sanskrit for improving brain function.
- To learn Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- To explore the huge knowledge from ancient literature.

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Order Introduction of roots, Technical information about Sanskrit literature.

Technical concepts of engineering-electrical, Mechanical, Architecture, Mathematics.

References:

1. Dr.Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, NewDelhi.
2. Prathama Deeksha-Vempati Kutumbshastri, , "Teach Yourself Sanskrit",Rashtriya Sanskrit Sansthanam, New DelhiPublication.
3. Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., NewDelhi.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understand basic Sanskrit language.
2. Study ancient Sanskrit literature about science &technology.
3. Use as a logical language to develop logic in students.

23CSCSACXX	VALUE EDUCATION	L	T	P	C
		2	0	0	0

Course Objectives:

- To understand value of education and self-development.
- To imbibe good values in students.
- To let the students know about the importance of character.

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship.

Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature. Character and Competence –Holy books vs Blind faith. Self-management and Good health.

Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

References:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, 2000.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Demonstrate knowledge of self-development.
2. Learn the importance of Human values.
3. Develop the overall personality.

23CSCSACXX	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

Course Objectives:

- To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working). Philosophy of the Indian Constitution: Preamble salient Features.

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality Right to FreedomRightagainstExploitationRighttoFreedomofReligion.Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.

Organs of Governance: Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected CEO of Municipal Corporation. Pachayat raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Election Commission: Election Commission: Role and Functioning .Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. "The Constitution of India, (Bare Act)", Government Publication,1950.

2. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis,2015.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understand the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Know the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Learn the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of1956.

23CSCSACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

Course Objectives:

- To review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- To identify critical evidence gaps to guide the development.

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support Peer support, Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

Research gaps and future directions: Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.

References:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2): 245-261,2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379,2004.
3. Akyeampong K, "Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER)",country report 1. London: DFID,2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33 (3): 272–282,2013.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand pedagogical practices that are being used by teachers in formal and informal classrooms in developing countries.
2. Appreciate the evidence on the effectiveness of these pedagogical practices, conditions, and the population of learners.
3. Realise the teacher education (curriculum and practicum), the school curriculum and guidance materials that best support effective pedagogy.

23CSCSACXX	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

Course Objectives:

- To achieve overall health of body and mind.
- To overcome stress.

Definitions of Eight parts of yoga. (Ashtanga).

Yam and Niyam.

Do`s and Don't's in life.

(i)Ahinsa, satya, astheya, bramhacharya andaparigraha (ii)Shaucha, santosh, tapa, swadhyay,ishwarpranidhan

Asan andPranayam

(i) Various yoga poses and their benefits for mind & body

(ii) Regularization of breathing techniques and its effects-Types of pranayam.

References:

1. Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal,Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department),Kolkata
3. Develop healthy mind in a healthy body thus improving social health also Improve efficiency.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Know the definitions of eight pats ofyoga.
2. Understand the Do's and don'ts in life.
3. Practice various yoga poses and realize their benefits.

23CSCSACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

Course Objectives:

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses-52,53,59(dont's), Verses- 71,73,75,78(do's).

Approach to day to day work and duties.

Shrimad Bhagwad Geeta : Chapter 2-Verses, Chapter 3-Verses 13, 21, 27, 35, Chapter 6 Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48. Statements of basic knowledge.

ShrimadBhagwadGeeta:Chapter2-Verses56,62,68,Chapter12-Verses13,14,15, 16,17,18,PersonalityofRolemodel.ShrimadBhagwadGeeta:Chapter2-Verses17,Chapter3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

References:

1. Swami Swarupananda,"Srimad Bhagavad Gita", Advaita Ashram Publication Department,1909.
2. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, NewDelhi.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. Understand person who has studied Geeta, who will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.

23CSCSACXX	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		2	0	0	0

Course Objectives :

- To understand the concepts IPR
- To understand Trademarks, Trade Secretes and GI of goods.
- To understand Copyrights, Patents and Industrial Designs.
- To learn about how to manage IP rights and legal aspects.
- To understand the concepts of Cyber laws in IPR.

Introduction to Intellectual Property: IPR - Definition - Types of IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; Few Case Studies WTO - Definition - Functions - Forms of IPR Protection.

Trade Marks: Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims.

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration

Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright.

Patents: Foundation of patent law, patent searching process, Basic Criteria of Patentability **Industrial Designs:** Kind of protection provided in Industrialdesign.

Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement.

Protecting IP Rights: nondisclosure agreement, cease and desist letter, settlement memorandum.

Transferring IP Rights: Assignment contract, license agreement, deed of assignment

Introduction to Cyber law: Information Technology Act, cybercrime and e-commerce, data security, confidentiality, privacy, international aspects ofcomputer and online crime.

Course Outcomes :

At the end of this course, students will demonstrate the ability to

1. Learner should be able to demonstrate understanding of basic concepts of IPR.
2. Able to differentiate between Trademarks, Trade secrets and GI of goods.
3. Able to understand Copyrights, Patents and Industrial Designs.
4. Able to manage and protect IP
5. Will gain Knowledge on Cyber law

References :

1. Bare Act, The Indian Patent Act 1970 and the Patent Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.
2. Mittal D.P., Indian Patents Law. Taxmann Allied Services (p) Ltd., 1999.
3. Deborah E Bouchoux, Intellectual Property: Right: The Law of Trademarks, Copyrights, Patents and Trade Secrets, 2012.
4. Gerald R. Ferrera, Cyber law: Text and Cases, South-Western Cengage Learning, 2012.
5. N.K Acharya, Intellectual property rights, Scandinavian Languages Edition, 2021.
6. Kompal Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications 2013.
7. P. Radhakrishna, Intellectual Property Rights: Text and Cases, Excel Books, 2008.