ANNAMALAI UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE & ENGINEERING

(FULL–TIME)

REGULATIONS AND SYLLABUS

REGULATIONS

Vision

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

Mission

- To impart high quality computer knowledge to the students by conducting education programmes.
- To provide exposure to the students about the emerging technological advancements for meeting the demands of the industry
- To advance discipline of computing through internationally recognized research and development
- To foster an environment that promotes extension activities and continuing education

M. E. (CSE) - PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. The broad knowledge of computer science serving as a foundation for on-going lifelong learning, and have demonstrated some success early in their professional careers and/or in the pursuit of post graduate studies
2. The creative and critical reasoning skills and are solving technical problems, ethically and responsibly, in service to society.
3. The mathematical and scientific knowledge and are solving emerging real-world problems related to programming, networking, information security, image analysis, and advanced computing systems, and are demonstrating that they possess the necessary communication, organization and teamwork skills for the execution of complex technological solutions
4. The necessary communication skills to bridge the divide between advanced technology and end users in the practice of computer science

M.E. (CSE) – PROGRAMME OUTCOMES (PO)

On successful completion of the Post Graduating course, the Computer Science and Engineering students will demonstrate:

1. **ANALYTICAL SKILLS:** Narrate familiarity in the knowledge of computing, mathematical concepts, algorithmic principles in computer science and engineering theory to fabricate computer based systems of varying complexity.

2. **RETRIEVAL SKILLS:** Analyze, generate, and interpret data to choose relevant procedures, resources and contemporary tools in computer science and engineering considering current and future trends.

3. **CREATIVE SKILLS:** Investigate and devise a computer based system to meet the necessary requirements within the realistic constraints such as economic, environmental, societal, ethical, safety and sustainability in the field of computer science and engineering.

4. **TEAM WORK AND PROFESSIONAL INTEGRITY:** Effectively function as a leader in multi-disciplinary teams and entrust on professional responsibilities to achieve a common objective.

5. **SPEAKING / WRITING SKILLS:** Correspond efficiently on intricate computing problems with all type of audiences and engrave valuable reports, documentation and oral presentations.

6. **ASSESSMENT SKILLS:** Broad analyzing capability on local and global impact of computing on individuals, organizations and society.

7. **SOCIAL AND CONTINUING EDUCATION PERCEPTION:** Express capability for sustainable professional development and life-long learning with a knowledge of contemporary issues for the growth of computer science and engineering field.

8. **CAREER AND IMMEDIATE EMPLOYMENT:** Recognize the significance of proficient perfection by pursuing studies to face competitive examinations and the ability to propose innovative methods in research for real-life problems that offer demanding and gratifying careers in computing.

M.E. (CSE) – MAPPING OF PO WITH PEO

Mapping PO with PEO				
POs	**PEO1**	**PEO2**	**PEO3**	**PEO4**
PO1	✓	✓		
PO2	✓	✓		
PO3	✓	✓	✓	
PO4	✓	✓	✓	✓
PO5		✓	✓	✓
PO6		✓	✓	✓
PO7				✓
PO8				✓

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY

M.E. / M. Tech (Two-Year Full Time & Three-year Part Time) DEGREE PROGRAMME

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

1. **Condition for Admission**
   Candidates for admission to the first year of the four-semester **M.E / M.Tech 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 equivalent thereto. They shall satisfy the condition regarding qualifying marks and physical fitness as may be prescribed by the syndicate of the Annamalai University from time to time. The admission for part time programme is restricted to those working or residing within a radius of **90 km** from Annamalainagar. The application should be sent through their employers.
2. **Branches of Study in M.E / M.Tech**
   The Branch and Eligibility criteria of programmes are given in **Annexure 1**
3. **Courses of study**
   The courses of study and the respective syllabi for each of the M.E / M. Tech programmes offered by the different Departments of study are given separately.
4. **Scheme of Examinations**
   The scheme of Examinations is given separately.
5. **Choice Based Credit System (CBCS)**
   The curriculum includes three components namely Professional Core, Professional Electives and Open Electives in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.
6. **Assignment of Credits for Courses**
   Each course is normally assigned one credit per hour of lecture / tutorial per week and one credit for two hours or part thereof for laboratory or practical per week. The total credits for the programme will be 65.
7. **Duration of the programme**
   A student of **M.E / M.Tech** programme is normally expected to complete in four semesters for full-time / six semesters for part-time but in any case not more than four years for full-time / six years for part-time from the date of admission.
8. **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 II shall be done at the appropriate semesters.

9. Electives

The student has to select two electives in first semester and another two electives in the second semester from the list of Professional Electives. The student has to select two electives in third semester from the list of Open Electives offered by the department/ allied department. A student may be allowed to take up the open elective courses of third semester (Full Time program) in the first and second semester, one course in each of the semesters to enable them to carry out thesis in an industry during the entire second year of study provided they should 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.

Further, the two open elective courses to be studied in III semester (Full Time programme) may also be credited through the SWAYAM portal of UGC with the approval of Head of the Department concerned. In such a case, the courses must be credited before the end of III Semester.

10. Assessment

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

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

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

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

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.

11. Student Counsellors (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 counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester,

monitor their progress in SWAYAM courses / open elective courses and obtain the final approval of the Head of the Department.

12. Class Committee

For each of the semesters of M.E / M.Tech 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 and first to sixth semesters for Part-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 Thesis supervisors.
- 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 be decided.

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 / 40 marks for practical and project work 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 for Full time / six years for Part time.**

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 65 credits within four semesters for full-time / six semesters for Part time 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 65 credits within two years and six months for full-time / three years and six months for Part time from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 65 credits within four years for full-time / six years for Part time from the time of admission.

18. Ranking Of Candidates

The candidates who are eligible to get the M.E /M.Tech degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester for M.E / M.Tech full-time / I to VI semester for M.E / M.Tech part-time.

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 for full-time / I to VI semester for M.E / M.Tech part-time.

19. Transitory Regulations

If a candidate studying under the old regulations M.E. / M.Tech could not attend any of the courses in his/her courses, shall be permitted to attend 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.

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme *
1	**Civil Engineering**	i.	Environmental Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Industrial Engg, Chemical Engg, BioChemical Engg, Biotechnology, Industrial Biotechnology, Chemical and Environmental Engg.
		ii.	Environmental Engineering & Management	
		iii.	Water Resources Engineering & Management	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Agricutural anf irrigation Engg, Geo informatics, Energy and Environmental Engg.
2	**Civil & Structural Engineering**	i.	Structural Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg.
		ii.	Construction Engg. and Management	
		iii.	Geotechnical Engineering	
		iv.	Disaster Management & Engg.	
3	**Mechanical Engineering**	i.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical Engg (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical (Manufacturing) Engg, Chemical Engg
4	**Manufacturing Engineering**	i.	Manufacturing Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, Mechatronics Engg, Industrial Engg.
		ii.	Welding Engineering	
		iii.	Nano Materials and Surface Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, Chemical Engg
5	**Electrical Engineering**	i.	Embedded Systems	B.E. / B.Tech – Electrical and Electronics Engg, Electronics & Instrumentation Engg, Control and Instrumentation Engg, Information technology, Electronics and communication Engg, Computer Science and Engg
		ii.	Smart Energy Systems	B.E. / B.Tech – Electrical and Electronics Engg, Electronics and Instrumentation Engg, Control and Instrumentation Engg.
		iii.	Power System	B.E. / B.Tech – Electrical and Electronics Engg,

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme *
6	**Electronics & Instrumentation Engineering**	i	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electronics Engg, Control and Instrumentation Engg, Instrumentation Engg
		ii.	Rehabilitative Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics.
		iii.	Micro Electronics and MEMS	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electronics Engg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics, Telecommunication Engg
7	**Chemical Engineering**	i.	Chemical Engineering	B.E. / B.Tech – Chemical Engg, Petroleum Engg, Petrochemical Technology
		ii.	Food Processing Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Biochemical Engg, Agricultural Engg.
		iii.	Industrial Bio Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Leather Technology
		iv.	Industrial Safety Engineering	B.E. / B.Tech – Any Branch of Engineering
8	**Computer Science & Engineering**	i.	Computer Science & Engineering	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
9	**Information Technology**	i	Information Technology	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
10	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech - Electronics and Communication Engg, Electronics Engg.

*** AMIE in the relevant discipline is considered equivalent to B.E**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Curriculum for M.E. (COMPUTER SCIENCE & ENGINEERING)

Full-Time

Sl. No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
Semester – I										
1	PC-I	CSEC 101	Mathematics for Computing	4		-	25	75	100	3
2	PC-II	CSEC 102	Advanced Algorithm and Data Structures	4		-	25	75	100	3
3	PC-III	CSEC 103	Computer Network Engineering and Management	4		-	25	75	100	3
4	PC-IV	CSEC 104	Graphics and Computer Vision	4		-	25	75	100	3
5	PE-I	CSEE 105	Professional Elective – I	4		-	25	75	100	3
6	PE-II	CSEE 106	Professional Elective – II	4		-	25	75	100	3
7	PC Lab-I	CSEP 107	Data Structures and Graphics using C++ Lab	-	3	-	40	60	100	2
			Total	**24**	**3**	**-**	**190**	**510**	**700**	**20**

Sl. No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
Semester – II										
1	PC-V	CSEC 201	Database Organization and Design	4	-	-	25	75	100	3
2	PC-VI	CSEC 202	Operating System Design	4	-	-	25	75	100	3
3	PC-VII	CSEC 203	Software Engineering Methodologies	4	-	-	25	75	100	3
4	PC-VIII	CSEC 204	Machine Learning Techniques	4	-	-	25	75	100	3
5	PE-III	CSEE 205	Professional Elective – III	4	-	-	25	75	100	3
6	PE-IV	CSEE 206	Professional Elective – IV	4	-	-	25	75	100	3
7	PC Lab-II	CSEP 207	Operating Systems and DBMS Lab	-	3	-	40	60	100	2
8	Semin	CSES 208	Seminar	-	2	-	100	-	100	1
			Total	**24**	**5**	**-**	**290**	**510**	**800**	**21**

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – III										
1	OE-I	CSEE 301	Open Elective – I	4	-	-	25	75	100	3
2	OE-II	CSEE 302	Open Elective – II	4	-	-	25	75	100	3
3	Thesis	CSET 303	Thesis Phase-I	-	-	4	40	60	100	4
4	Ind Train	CSEI 304	Industrial Training	-	-	*	100	-	100	2
			Total	**8**	**-**	**4**	**190**	**210**	**400**	**12**

Note: * - Four weeks during the summer vacation at the end of IInd Semester

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – IV										
1	Thesis	CSET 401	Thesis Phase-II	-	-	8	40	60	100	12
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**12**

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

Part Time

Sl. No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – I											
1	PC-I	PCSEC 101	Mathematics for Computing	4	-	-	25	75	100	3	CSEC 101
2	PC-II	PCSEC 102	Advanced Algorithm and Data Structures	4	-	-	25	75	100	3	CSEC 102
3	PC-III	PCSEC 103	Computer Network Engineering and Management	4	-	-	25	75	100	3	CSEC 103
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – II											
1	PC-IV	PCSEC 201	Database Organization and Design	4	-	-	25	75	100	3	CSEC 201
2	PC-V	PCSEC 202	Operating System Design	4	-	-	25	75	100	3	CSEC 202
3	PC-VI	PCSEC 203	Software Engineering Methodologies	4	-	-	25	75	100	3	CSEC 203
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – III											
1	PC-VII	PCSEC 301	Graphics and Computer Vision	4	-	-	25	75	100	3	CSEC 104
2	PE-I	PCSEE 302	Professional Elective – I	4	-	-	25	75	100	3	CSEE 105
3	PE-II	PCSEE 303	Professional Elective – II	4	-	-	25	75	100	3	CSEE 106
4	PC Lab-I	PCSEP 304	Data Structures & Graphics using C + + Lab	-	3	-	40	60	100	2	CSEP 107
			Total	**12**	**3**	**-**	**115**	**285**	**400**	**11**	

S.No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – IV											
1	PC-VIII	PCSEC 401	Machine Learning Techniques	4	-	-	25	75	100	3	CSEC 204
2	PE-III	PCSEE 402	Professional Elective – III	4	-	-	25	75	100	3	CSEE 205
3	PE-IV	PCSEE 403	Professional Elective – IV	4	-	-	25	75	100	3	CSEE 206
4	PC Lab-II	PCSEP 404	Operating Systems and DBMS lab	-	3	-	40	60	100	2	CSEP 207
5	Semin	PCSES 405	Seminar	-	2	-	100	-	100	1	CSES 208
			Total	**12**	**5**	**-**	**215**	**285**	**500**	**12**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – V											
1	OE-I	PCSEE 501	Open Elective – I	4	-	-	25	75	100	3	CSEE 301
2	OE-II	PCSEE 502	Open Elective – II	4	-	-	25	75	100	3	CSEE 302
3	Thesis	PCSET 503	Thesis Phase-I	-	-	4	40	60	100	4	CSET 303
4	Ind Train	PCSEI 504	Industrial Training	-	-	*	100	-	100	2	CSEI 304
			Total	**8**	**-**	**4**	**190**	**210**	**400**	**12**	

Note: * - Four weeks during the summer vacation at the end of IVth Semester

Sl. No.	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S e m e s t e r – VI											
1	Thesis	PCSET 601	Thesis Phase-II	-	-	8	40	60	100	12	CSET 401
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**12**	

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

LIST OF PROFESSIONAL ELECTIVES

S.No	Professional Electives
1	Multicore Architecture
2	Advanced Image Processing
3	Advanced Mobile Computing
4	VLSI Technology
5	Knowledge Based Systems
6	Advanced Computer Architecture
7	Object Oriented Modeling and Design
8	Real Time System concepts

9	Data Mining and Warehousing
10	Design and Analysis of Parallel Algorithms
11	Advanced System Software
12	Network and Information Security
13	Design of Embedded Control System
14	Software Project Management
15	Advanced Natural Language Processing
16	Mobile Adhoc Networks
17	Software Quality and Testing
18	Digital Steganography and Watermarking
19	Speech and Audio Signal Processing
20	Image Mining and Repository
21	Medical Image Processing
22	Optimization Techniques
23	Wireless Sensor Networks
24	Digital Video Processing

LIST OF OPEN ELECTIVES

S.No	Open Electives
1	Big Data Analytics
2	Cloud Computing Technologies
3	Wearable Computing
4	Internet of Things (IoT)
5	Multimedia Systems
6	Advanced Web Design
7	Internet Programming Tools
8	Mobile Application Development Framework
9	Advanced Soft Computing
10	Human Computer Interaction

CSEC101	MATHEMATICS FOR COMPUTING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of Linear programming problem, PERT-CPM

Random Variables – Probability Function – Moments – Moment Generating Functions and Their Properties – Binomial, Poisson, Uniform and Normal Distributions – Functions of a Random Variable.

Joint Distributions – Marginal and Conditional Distributions – Functions of Two Dimensional Random Variables – Regression Curve – Correlation.

Sampling Distributions – Type I and Type II Errors – Tests based on Normal, t, chi square and F Distributions For Testing Of Mean, Variance And Proportions – Tests for Independence of Attributes and Goodness of Fit.

Design of experiments and statistical quality control:
Basic principle of experimental design – completely randomized design – analysis of variance for one way classification or one factor experiments – Randomized block design – Analysis of variance for two way classification or two factor experiments – Latin square design – Analysis of variance for three factor experiments – RDB and LSD comparison.

Formulation – Graphical method – Simplex method – Big M Method – Transportation and assignment problems – Travelling salesman problem - Project Scheduling by PERT and CPM

REFERENCES:

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury, 2002.
2. Richard Johnson, "Miller & Freund's Probability and Statistics for Engineer", Prentice Hall , Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Fifth Edition, 2002.
4. Gupta S.C. and Kapoor V.K."Fundamentals of Mathematical Statistics", Sultan and Sons, 2001.
5. Dallas E Johnson et al., "Applied multivariate methods for data analysis", Thomson and Duxbury press, 1998.
6. Hamdy A Taha, "Operations Research: AN Introduction", Prentice Hall of India Pvt Ltd, New Delhi, Eighth Edition, 2007

COURSE OUTCOMES:

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

1. Identify the type of random variable and distribution for a given operational conditions/scene
2. Study and Design appropriate distribution model for a given problem/system situation
3. Differentiate/infer the merit of sampling tests.
4. Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2			✓					
CO3				✓				
CO4		✓						✓

CSEC102	**ADVANCED ALGORITHM AND DATA STUCTURES**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To be familiar with basic techniques of algorithm analysis.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To emphasize the concept of data abstraction and understanding of abstract data types.
- To assess how the choice of data structures and algorithm design methods impacts the performance of programs

Mathematical Review – Basic Concepts of Object Oriented Programming – C++ Features – Recursion – Abstract Data Types – Algorithm Analysis – NP completeness.

Data Structures - List ADT – Implementation – Arrays, Cursors, Pointers – Stack and Queue ADT – Implementation – Applications - Trees ADT – Tree Traversals – Binary Search Trees – Expression Trees – AVL Trees – Splay trees - Set ADT – Basic Operations – Advanced Set Representation – Priority Queue – Applications.

Algorithms – Greedy Method - Knapsack problem – Minimum Cost Spanning Trees – Divide and Conquer Method – Quick Sort - Binary Search - Dynamic Programming – Single Source Shortest Path Problem – Multistage Graphs – Backtracking – Graph Coloring – 8 Queens Problem.

Branch and Bound Method – LC Branch-and-Bound – FIFO Branch-and-Bound - Traveling Salesman Problem - Basic Traversal and Search techniques - Breadth First Search and Traversal - Depth First Search and Traversal - Connected Components and Spanning Trees - Biconnected Components and DFS.

Polynomials – Evaluation – Horner's Method – Matrices – Operations – Multiplication – Strassen's Method – Inversion – Solving Systems of Linear Equations.

REFERENCES:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C++", Benjamin Cummings, 1994.
2. E. Horowitz, S.Sahini, S. Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publications Pvt. Ltd., 1988.
3. Gilles Brassard and Paul Bratley, "Fundamentals of Algorithmics", PHI, 2001.
4. T. H. Corman, C.E. Leiserson & R. L. Rioest, "Introduction to Algorithms", McGraw Hill company, 1994.
5. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison Wesley Publishing Company, 1985.
6. Sara Baase, "Computer Algorithms: Introduction to Design and Analysis", Addison Wesley Publishing Company, 1988.

COURSE OUTCOMES:

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

1. Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency.
2. Apply data abstraction in solving programming problems.
3. Master different algorithm design techniques
4. Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2			✓					
CO3				✓				
CO4		✓						✓

CSEC103	COMPUTER NETWORK ENGINEERING AND MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To know the fundamentals of network architectures
- To explicate various protocols and its functionalities
- To study about different network management standards

Introduction - Network hardware - Network software - Reference models: OSI reference model - TCP/IP reference model - Comparison - Data link layer design issues - Error detection and correction - Multiple access protocols - 802.11 architecture and protocol stack - 802.16 architecture and protocol stack - Bluetooth architecture and protocol stack.

Network layer design issues - Routing algorithms: Shortest path algorithm - Flooding - Hierarchical routing - Broadcast routing - Multicast routing - Congestion control algorithms - Circuit switched network access - Packet switched network access - X.25 - ISO Internet Protocol standards - TCP/IP Internet Protocol standards.

The Transport layer: The transport service - Elements of transport protocols - UDP - TCP - The session layer: Session characteristics - session service - ISO session protocol - Other session approaches.

Presentation layer design issues - Virtual Terminal Protocols - File Transfer Protocol - Application layer design issues - Electronic Mail - Overview of ISDN - ISDN protocols.

Architecture of network management protocols - Information extraction - Configuration Management - Fault Management - Performance Management - Security Management - Accounting Management - Capacity planning.

REFERENCES:

1. Andrew S. Tanenbaum, David J. Wetherall "Computer Networks", Prentice Hall, Fifth Edition, 2011.
2. William Stallings, "Data and Computer Communications," Fifth Edition, PHI, 2005.
3. Peterson & Davie, "Computer Networks, A Systems Approach", Fifth Edition, Harcourt, 2011.
4. Ulysses Black, "Network Management Standards", Second Edition, McGraw Hill, 1994.
5. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-down Approach", Sixth Edition, Pearson, 2013.
6. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, McGraw Hill, 2011.

COURSE OUTCOMES:

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

1. Acquire the knowledge of network layered approaches.
2. Understand the algorithms and operations of various protocols.
3. Analysis and implement new protocols for various network functionalities.
4. Design the architecture of network management.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2					✓			
CO3		✓	✓					
CO4				✓			✓	

CSEC104	**GRAPHICS AND COMPUTER VISION**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To review computer graphics techniques for computer vision
- To understand imaging and filtering operations.
- To study shape and boundary pattern analysis techniques.
- To explain 3D vision methods.
- To study some applications and case studies of computer vision algorithms

Overview of Graphics systems – Line drawing algorithms – Area filling algorithms - 2D Clipping: Point and line clipping – polygon, curve, text clipping. 2D Transformations: Basic transformations – matrix representations – composite transformations – 3D viewing.

Visible surface detection methods – Illumination models: Basic illumination models – Diffuse reflection – Specular reflection – Phong model – Gouraud shading - Phong shading - Color models.

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 labeling – Size filtering – Distance functions – Skelton and thinning. Boundary pattern analysis: Boundary tracking – Centroidal profiles – Occlusion problems - Pattern matching techniques.

3D - Vision and variety of methods – Shape and shading – Photometric stereo – Shape and texture – 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., NewDelhi – 1998.
2. E. R. Davies, "Computer and Machine Vision: Theory, Algorithms, Practicalities", Fourth edition, Academic Press.
3. Foley J.D., Van dam A., Feiner SK., Hughes JF., "Computer Graphics Principles and Practice", Addison-Wesley Publishing Company, 1993.
4. Forsyth, David A., and Jean Ponce. "A modern approach." Computer vision: a modern approach. PHI
5. Bernd Jähne, Horst Haussecker, Computer Vision and Applications: A Guide for Students and Practitioners, Academic Press

COURSE OUTCOMES:

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

1. Implement computer graphics techniques required for computer vision.
2. Apply the concepts of visible and illumination methods.
3. Implement 3D vision techniques.
4. Develop computer vision algorithms

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓	✓	✓		✓	✓	✓
CO2	✓		✓	✓	✓	✓		✓
CO3		✓		✓		✓	✓	✓
CO4	✓	✓	✓		✓		✓	✓

CSEP107	DATA STRUCTURES AND GRAPHICS USING C++ LAB	L	T	P
		0	0	3

COURSE OBJECTIVES:

- To develop skills to design and analyze simple linear and non linear data structures.
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem.
- To Gain knowledge in practical applications of data structures.
- To understand the need of developing graphics applications.
- To learn algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc.
- To learn the representation and three dimensional transformation.

LIST OF EXERCISES
CYCLE – I

1(a). Write a C++ Program to implementation of Stack.

1(b). Write a C++ Program to perform Evaluation of Expression.

2. Write a C++ Program to implementation of Queue.

3. Write a C++ Program to implementation of Priority Queue.

4(a). Write a C++ Program to perform Single Linked List.

4(b). Write a C++ Program to perform Double Linked List.

4(c). Write a C++ Program to perform Circular Linked List.

5. Write a C++ Program to creation of Binary Tree Traversal.

6(a). Write a C++ Program to perform Merge Sort.

6(b). Write a C++ Program to perform Heap sort.

6(c). Write a C++ Program to perform Bubble Sort.

6(d). Write a C++ Program to perform Quick Sort.

7(a). Write a C++ Program to perform Sequential Search.

7(b). Write a C++ Program to perform Binary Search.

CYCLE – II

8. Write a C++ Program to draw a line using DDA and Bresenham line drawing algorithm.
9. Write a C++ Program to draw a circle and ellipse using midpoint circle algorithm and midpoint ellipse algorithm.
10. Write a C++ Program to perform three dimensional transformations.

11. Write a C++ Program to perform polygon clipping using sutherland hodgeman algorithm.
12. Write a C++ Program to draw a beizer curve.
13. Write a C++ Program to draw bspline curve.
14. Write a C++ Program to generation of natural sceneries using fractals.

COURSE OUTCOMES:

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

1. Understand to design and analyze the time and space efficiency of the data structure
2. Understand and capable to identity the appropriate data structure for given problem
3. Understand the practical knowledge on the application of data structures
4. Understand the need of developing graphics applications
5. Learned algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc. and the representation and three dimensional transformations

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓		✓	✓
CO2	✓	✓		✓		✓		✓
CO3	✓	✓	✓			✓		✓
CO4	✓		✓		✓		✓	✓
CO5	✓	✓		✓		✓	✓	✓

CSEC201	**DATABASE ORGANIZATION AND DESIGN**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of DBMS, E-R Diagrams and to impart the concepts of the Relational model, SQL, various Normal Forms and Query Processing.
- To inculcate the fundamentals of Transaction Management, Data mining and Data Warehousing.
- To disseminate the knowledge on Emerging Database Technologies.

File System vs. DBMS – Views of data – Data Models – Database Languages – Database Management System Services – Overall System Architecture – Data Dictionary – Entity –

Relationship (E-R) – Enhanced Entity – Relationship Model (E-E-R). Relational Model – Keys – Relational Algebra – Relational Calculus - SQL.

Functional Dependencies – Pitfalls in Relational Database Design – Decomposition – Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain - Key Normal form. Query Processing Overview – Estimation of Query Processing Cost - Join strategies.

Transactions: Concepts and States – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Implementation of Isolation – Testing for Serializability . Concurrency control: Lock Based Protocols – Timestamp Based Protocols – Validation Based Protocols – Multiple Granularity – Deadlock Handling. Recovery System: Failure classification – Storage Structure – Recovery and Atomicity – Log Based Recovery – Recovery with concurrent transaction – Buffer Management.

Introduction - Data Mining: Data Mining Process - Data Mining Knowledge Discovery. Data Warehousing: Evolution of Data Warehouse concept – Main components of Data Warehouses – Characteristics of Data Warehouses- Benefits and Limitations of Data Warehouses. Data Warehouse Architecture: Data Marts – On Line Analytical processing (OLAP).

Introduction - Internet databases – Digital Libraries – Multimedia Databases – Mobile Databases – Spatial Databases – Data base design: Case Studies

REFERENCES:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fifth Edition, McGraw Hill, 2006.
2. S.K.Singh , "Database Systems concepts , Design and Applications", Second Impression, Pearson Education , 2008.
3. Elmasri.R, Navathe. S.B, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2007.
4. Date. C.J, Kannan.A and Swamynathan. S, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
5. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2009.

COURSE OUTCOMES:

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

1. Differentiate database systems from file systems by enumerating the features provided by database systems, Analyze data storage problem and derive a data model using E-R Diagrams and Formulate the solutions to a broad range of query and data update problems using SQL
2. Understand the normalization theory and apply such knowledge to the normalization of a database
3. Design and implement Transaction management, Data Mining and Data Warehousing.

4. Inculcate the various emerging database technologies.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓						✓
CO2			✓					✓
CO3		✓	✓		✓	✓		
CO4		✓	✓			✓		✓

CSEC202	**OPERATING SYSTEM DESIGN**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems , Processes, Deadlocks, inter-process communication, synchronization and mutual exclusion
- To gain knowledge on memory management concepts and design issues.
- To gain insight on to the I/O devices and Device management design issues.
- To know the components and management aspects of File system and to understand the OS protection mechanisms.
- Understanding the various operating system design issues with the help of case studies

Definition of OS - Operating system Operations - Types of OS - Process – Process control Block – Process scheduling--problems on process scheduling – Threads-Deadlock Characterization- Methods for Handling Deadlocks- Deadlock Prevention- Deadlock Avoidance-Problems on Deadlock Avoidance- Principles of Concurrency- Mutual Exclusion- Hardware-Support-Semaphores

The Memory Management Design Problem -Dynamic Memory Allocation- Keeping Track of the Blocks- Memory Protection-Memory Hierarchy-Logical and Physical address- Paging-Segmentation-Paging and Segmentation-Fragmentation and Compaction- Page Replacement Algorithms – Problems on Page Replacement algorithms-Evaluating Paging Algorithms-Thrashing and Load Control-IO Devices-Devices and Controllers-Modeling of Disks-Device numbers-Unification of Files and I/O Devices-Generalized Disk Device Drivers-Disk Caching-SCSI Device Drivers-Disk Scheduling Algorithms-Problems on Disk Scheduling

File System: File System Implementation-File System Organization-File System Organization-File Descriptors-How File Blocks Are Located On Disk-Review of File Storage Methods-Implementation of the Logical to Physical Block Mapping-File Sizes-Booting the Operating System-File System Optimization-File System Reliability-File Security and Protection- Access Matrix - Implementation of Access Matrix-Access Control-The Security Problem-Program Threats-System and Network Threats-User Authentication-Mechanisms for Protecting Hardware Resources-Representation of Protection Information-Mechanisms For Software Protection

UNIX: History - Design Principles - Programmer Interface - User Interface - Process Management - Memory Management - File System - I/O System - Inter-process Communication

Embedded Operating Systems: Embedded Systems- Characteristics of Embedded Operating Systems- eCOS- TinyOS - Computer Security Concepts - Threats-Attacks and Assets – Intruders-Malicious Software Overview-Viruses- Worms- Bots-Rootkits.

REFERENCES:

1. Charles Crowley, Operating Systems: A Design-Oriented Approach, First edition McGraw-Hill, 1996
2. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
3. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.
4. Andrew S. Tanenbaum, Albert S. Woodhull, Operating Systems , Design And Implementation Third Edition, Prentice Hall, 2006
5. H. Deitel, P. Deitel, and D. Choffnes . *Operating Systems*. Prentice Hall, 2003

COURSE OUTCOMES:

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

1. Demonstrate understanding of the concepts, structure and design of operating Systems
2. Demonstrate understanding of operating system design and its impact on application system design and performance
3. Demonstrate competence in recognizing and using operating system features

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2								
CO3	✓		✓					✓

CSEC203	SOFTWARE ENGINEERING METHODOLOGIES	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To introduce the various software development process models
- To explain the phases of software development
- To facilitate an understanding of umbrella activities in software development

The Nature of Software – The Unique Nature of WebApps – Software Engineering – The Software Process – Software Engineering Practice - Process Models – A Generic Process Model – Prescriptive Process Models- Specialized Process Models Agile Development – What is Agility? – Agility Principles – The Politics of Agile Development – Human Factors – Extreme Programming – XP Values – The XP Process – Feature Driven Development(FDD) – Lean Software Development(LSD).

Requirements Engineering – Establishing the ground Work – Requirements analysis - Overall Objectives and Philosophy – Requirements Modeling Approaches – Data Modeling Concepts – Requirements Modeling Strategies – Flow Oriented Modeling –Creating a Behavioral model - Design Concepts – The Design Process – Design Concepts – The Design Model – Software Architecture – Architectural Genres – Architectural Styles – Architectural Design – Architectural Mapping Using Data Flow – What is a Component? – Designing Class-Based Components – Component-Level Design for WebApps – Designing Traditional Components.

User interface design - The Golden rules – Interface Design Steps – WebApp Interface Design – WebApp Design Quality – Design Goals – A Design Pyramid for WebApps – Aesthetic Design – Content Design – Architecture Design – Navigation Design - Quality Concepts – What is Quality? – Software Quality - Review Techniques – Defect Amplification and Removal – Reviews: A Formality Spectrum – Informal Reviews – Formal Technical Reviews – Elements of Software Quality Assurance – SQA Tasks, Goals and Metrics – Formal Approaches to SQA – Statistical Software Quality assurance – Software Reliability – The ISO 9000 Quality Standards – The SQA Plan.

Software Testing Strategies - A Strategic Approach to Software Testing - Strategic Issues ¬- Test Strategies for Conventional Software - Test Strategies for Object-Oriented Software - Test Strategies for WebApps - Validation Testing - System Testing - The Art of Debugging - Testing Conventional Applications - Software Testing Fundamentals - White-Box Testing - Basis Path Testing - Control Structure Testing - Black-Box Testing.

Software Configuration Management - The SCM Repository - The SCM Process - Process and Project Metrics - Metrics in the Process and Project Domains - Software Measurement - Estimation For Software Projects - Software Project Estimation - Decomposition Techniques -

Empirical Estimation Models - Estimation for Object-Oriented Projects - Specialized Estimation Techniques - The make/Buy Decision - Risk Management - Reactive versus Proactive Risk Strategies - Software Risk - Risk Identification - Risk Projection - Risk Refinement - Risk Mitigation, Monitoring and Management - The RMMM plan - Software Maintenance - Software Supportability.

REFERENCES:

1. Roger Pressman S., "Software Engineering : A Practitioner's Approach", Seventh Edition McGraw Hill, 2009.
2. Ian Sommer Ville, "Software Engineering", Addison Wesley, 1996.
3. Elfriede Dustin, Thom Garrett, Bernie Gauf, "Implementing Automated Software Testing", Pearson Education, 2009.
4. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance: Theory and Practice", Wiley, 2008.
5. Rod Stephens, "Beginning Software Engineering", Wiley, 2015.

COURSE OUTCOMES:

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

1. Select and apply the process methodology suitable for software application development.
2. Develop the design models for software applications.
3. Apply the testing strategies and techniques in real world situations.
4. Estimate project cost, effort, duration and risks for software projects.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓	✓			✓		✓
CO2	✓	✓	✓	✓		✓		
CO3	✓	✓						
CO4			✓	✓	✓	✓		

CSEC204	**MACHINE LEARNING TECHNIQUES**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To introduce the fundamental concepts of machine learning and its applications
- To learn the classification, clustering and regression machine learning algorithms

- To understand the methods of solving real life problems using the machine learning techniques

Introduction and Bayesian Decision Theory: Machine perception - feature extraction - classification, clustering and regression - design cycle - types of learning. Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

Component analysis and Hidden Markov Models: Principal component analysis - Linear discriminant analysis - Independent component analysis. Expectation-maximization algorithm - hidden Markov models: Evaluation - decoding - learning.

Classification Algorithms: Perceptron and backpropagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbor rule. Support vector machine: Training - multicategory generalizations. Decision trees: classification and regression tree - random forest.

Clustering and Regression Algorithms: k-means clustering - fuzzy k-means clustering - Gaussian mixture models - autoassociative neural network. Regression analysis - support vector regression.

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.

REFERENCES:

1. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", Second edition, John Wiley & Sons, Singapore, 2003.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
4. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
5. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

COURSE OUTCOMES:

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

1. understand the basic concepts of machine learning
2. implement the classification, clustering and regression algorithms
3. design and implement a method for solving real life problem using a suitable machine learning technique
4. combine the evidence from two or more models/methods for designing a system.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓					
CO2	✓	✓						
CO3							✓	✓
CO4							✓	✓

CSEP207	**OPERATING SYSTEMS AND DBMS LAB**	**L**	**T**	**P**
		0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols Master the basics of SQL and construct queries using SQL.
- Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
- Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.
- To present the concepts and techniques relating to ODBC and its implementations.

LIST OF EXERCISES
OPERATING SYSTEM

1. CPU Scheduling Algorithms
    a. First Come First Served Scheduling
    b. Shortest Job First Scheduling
    c. Priority Scheduling
    d. Round Robin Scheduling

2. Producer Consumer Problem
3. Matrix Multiplication using Multithreading
4. Bankers Algorithm
5. Paging
6. Segmentation

7. Dynamic Storage Allocation Problem
8. Disk Scheduling
9. File Management

DBMS

1. Student management system using SQL commands
2. Employee management using PL/SQL functions
3. Creation of Index and Trigger
4. Creation of Table Partition
5.ODBC and JDBC Connectivity

COURSE OUTCOMES:

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

1. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
2. Learn the various resource management techniques for distributed systems
3. Design and implement a database schema for a given problem-domain
4. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
5. Design and build a GUI application using a 4GL

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓	✓	✓	
CO2	✓	✓		✓		✓	✓	✓
CO3	✓		✓	✓	✓		✓	✓
CO4		✓		✓	✓		✓	✓
CO5	✓		✓		✓	✓		✓

CSES208	SEMINAR	L	T	P
		0	0	2

COURSE OBJECTIVES:

- To work on a technical topic related to Computer Science and Engineering and acquire the ability of written and oral presentation
- To acquire the ability of writing technical papers for Conferences and Journals

The students will work for two periods per week guided by student counselor. They will be asked to present a seminar of not less than 15 minutes and not more than 30 minutes on any technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation, the report and also on the interaction shown during the seminar.

COURSE OUTCOMES:

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

1. The students will be trained to face the audience and to interact with them confidently
2. To tackle any problem during group discussion in the corporate interviews
3. To acquire the ability to work in the actual environment and to use the technical resources

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓	✓	✓	
CO2	✓	✓		✓		✓	✓	✓
CO3	✓		✓	✓	✓		✓	✓

CSET303	THESIS PHASE - I	L	T	P
		0	4	0

COURSE OBJECTIVES:

- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario
- To develop skills on the research topic and to implement the appropriate methods to handle the issue

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, the students will be able to

1. Conduct independent empirical research to evaluate and present their results responsibly and critically
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓	✓	✓	
CO2	✓	✓		✓			✓	✓
CO3	✓	✓		✓	✓		✓	✓

CSEI304	INDUSTRIAL TRAINING	L	T	P
		0	*	0

Note: * - Four weeks during the summer vacation at the end of IInd Semester

COURSE OBJECTIVES:

- To train the students in the field work related to Computer Science and Engineering and to have a practical knowledge in carrying out the Computer Science and Engineering related problems
- To train and develop skills in solving problems during execution of the problems related to Computer Science and Engineering

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.

COURSE OUTCOMES:

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

1. Apply prior acquired knowledge in problem solving and to demonstrate the use, interpretation and application of an appropriate international Computer Science and Engineering standard in a specific situation
2. Analyze a given Computer Science and Engineering problem and to identify and implement appropriate problem solving methodology to propose a meaningful solution
3. Present the solution acquired in the form of written and oral presentation

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓		✓	✓
CO2	✓	✓		✓		✓	✓	
CO3	✓		✓	✓	✓		✓	✓

CSET401	THESIS PHASE - II	L	T	P
		0	8	0

COURSE OBJECTIVES:

- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario
- To develop skills on the research topic and to implement the appropriate methods to handle the issue

The students will continue the research problem undertaken during third semester for Full-Time / Fifth 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, the students will be able to

1. Conduct independent empirical research to evaluate and present their results responsibly and critically
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓		✓		✓	✓	✓	
CO2	✓	✓		✓			✓	✓
CO3	✓	✓		✓	✓		✓	✓

PROFESSIONAL ELECTIVES

CSEE XOX	MULTICORE ARCHITECTURE	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architecture and identify
- performance related parameters
- To understand the different multiprocessor issues
- To expose the different types of multicore architectures
- To understand the design of the memory hierarchy

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era.

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers, Cloud Computing – Architectures and Issues – Case Studies.

Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism.

REFERENCES:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.
2. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010.
4. Wen– mei W. Hwu, "GPU Computing Gems", Morgan Kaufmann / Elsevier, 2011.
5. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill Education, 2003.
6. Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", Prentice Hall, 2011.

COURSE OUTCOMES:

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

1. Identify the limitations of ILP and the need for multicore architectures
2. Discuss the issues related to multiprocessing and suggest solutions
3. Point out the salient features of different multicore architectures and how they exploit parallelism
4. Critically analyze the different types of inter connection networks
5. Design a memory hierarchy and optimize it

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1		✓						
CO2	✓							
CO3	✓		✓					
CO4	✓							
CO5		✓						

CSEE XOX	**ADVANCED IMAGE PROCESSING**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand representation of digital images in the spatial and frequency domains.
- To understand Image Compression, Segmentation and image compression standards.
- To provide an in-depth understanding of various concepts related to image Representation and Description

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.
2. A. K. Jain, Fundamentals of digital image processing, Prince-Hall India.
3. K. R. Castleman, Digital Image Processing, Prince-Hall International.
4. A.L.Bovik, Handbook of Image and Video Processing, Elsevier.
5. Yao Wang, Joern Ostermann, Ya-Qin Zhang, Video Processing in Communication
6. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, ISBN: 0130618721, PHl, 2004

COURSE OUTCOMES:

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

1. Acquire knowledge of principles of digital image processing.
2. To be able to solve problems pertaining to the field of image acquisition, preprocessing, Fourier domain processing.
3. To perform basic image restoration, image segmentation and image compression.
4. To provide the foundations for life-long learning and continual professional development in the areas of image applications.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2	✓	✓						
CO3			✓					
CO4			✓	✓	✓		✓	✓

CSEE XOX	ADVANCED MOBILE COMPUTING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To make the student understand the concept of mobile computing paradigm, its novel applications and limitations
- To understand the typical mobile networking infrastructure through a popular GSM Protocol
- To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
- To understand the database issues in mobile environments & data delivery models
- To understand the ad hoc networks and related concepts
- To understand the platforms and protocols used in mobile environment

Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.

Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

REFERENCES:

1. J.Schiller “Mobile Commnications “, Addison Weseley, Second edition, 2000.
2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007.
3. Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley Publishing, 2003.
4. Mischa Schwartz, “Mobile Wireless Communications” 1st Edition, Cambridge University Press, 2005
5. William Stallings, “Wireless Communications & Networks”, 2nd edition, Pearson.

COURSE OUTCOMES:

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

1. Grasp the concepts and features of mobile computing technologies and applications.
2. Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support.
3. Identify the important issues of developing mobile computing systems and applications.
4. Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓				✓		
CO2		✓	✓		✓	✓		
CO3	✓						✓	
CO4	✓		✓		✓			

CSEE XOX	**VLSI TECHNOLOGY**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To design and analyze digital circuits
- To layout design techniques
- To synthesis tool for hardware design
- To Introduced digital integrated circuits

MOS Technology and VLSI - Process parameters considerations for BJT – MOS and CMOS – Electrical properties of MOS circuits and Device Modelling – MOS Layers – Stick diagram – Layout diagram – Propagation delays – Examples of Combinational logic design – Sealing of MOS circuits.

Programmable Logic Array (PLA) and Finite State Machines – Design of ALUs – Memories and Registers – Introduction to Analog VLSI - Realization of Neural Networks and Switched capacitor filters – Sub-Micron technology and GaAs VLSI technology.

Electronic Grade Silicon – Czochralski Growing – Silicon shaping – Processing consideration – Vapor Phase Epitaxy – Molecular Beam Epitaxy - Silicon on Insulators – Epitaxial Evaluation –

Growth Mechanic and kinetics – Thin Oxides – Oxidation Techniques Systems – Oxide properties – Redistribution of Dopants at Interface – Oxidation of Poly Silicon – Oxidation Induced Defects.

Optical Lithography – Electron Lithography – X-ray Lithography – Ion Lithography – Plasma properties – Feature size control and Anisotropic Etch Mechanism – Relative Plasma Etching Techniques and Equipments.

Deposition Processes – Polisilicon – Plasma Assited Deposition – Models of Diffusion in Solids – Flick's one Dimensional Diffusion Equation – Atomic Diffusion Mechanism – Measurement Techniques – Range Theory – Implantation Equipment – Annealing Shalloe Junction – High Energy Equipment – Annealing Shalloe Junction – High Energy Implantation – Physical vapor Deposition – Pattering.

REFERENCES:

1. Douglas A. Pucknell and Kamran Eshraghin, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt. Ltd., 1993.
2. Wayne Wolf, "Modern VLSI Design", 2nd Edition, Prentice Hall, 1998.
3. Amar Mukherjee, "Introduction to NMOS and CMOS VLSI System Design", Prentice Hall, 1986.
4. Randall L.Geiger and P.E. Allen, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Company, 1990.
5. Fabricious E,"Introduction to VLSI Design", McGraw Hill, 1990.
6. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
7. S.M. Sze, "VLSI Technology", McGraw Hill, 2nd Edition, International Edition, 1998, Electrical and Electronic Engineering Series 1988.

COURSE OUTCOMES:

At the end of this course, the students will be

1. Aware about the trends in semiconductor technology, and how it impacts scaling and performance.
2. Able to learn Layout, Stick diagrams, Fabrication steps, Static and Switching characteristics of inverters.
3. Able to synthesis the digital VLSI systems from register-transfer or higher level descriptions in hardware design languages.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓						
CO2		✓	✓					
CO3			✓	✓				✓

CSEE XOX	**KNOWLEDGE BASED SYSTEMS**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To learn the concepts of knowledge base and inference engine.
- Expert Systems, Architecture and Programming.
- Machine Learning.

Introduction to Knowledge Engineering: The Human Expert and an Artificial Expert – Knowledge Base and Inference Engine – Knowledge Acquisition and Knowledge Representation.

Problem Solving Process: Rule Based Systems – Heuristic Classifications – Constructive Problem Solving.

Tools For Building Expert Systems - Case Based Reasoning – Semantic Of Expert Systems – Modeling Of Uncertain Reasoning – Applications Of Semiotic Theory; Designing For Explanation.

Expert System Architectures - High Level Programming Languages – Logic Programming For Expert Systems.

Machine Learning – Rule Generation and Refinement –Learning Evaluation – Testing and Tuning.

REFERENCES:

1. Peter Jackson, ”Introduction to Expert Systems”, 3rd Edition, Pearson Education 2007.
2. Robert I. Levine, Diane E. Drang, Barry Edelson: “ AI and Expert Systems: a comprehensive guide, C language”, 2nd edition, McGraw-Hill 1990.
3. Jean-Louis Ermine: “Expert Systems: Theory and Practice”, 4th printing, Prentice-Hall of India , 2001.

4. Stuart Russell, Peter Norvig: "Artificial Intelligence: A Modern Approach", 2nd Edition,Pearson Education, 2007.
5. Padhy N.P.: "Artificial Intelligence and Intelligent Systems", 4th impression, Oxford University Press, 2007.

COURSE OUTCOMES:

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

1. Understand the knowledge-based systems engineering.
2. Understand Expert System.
3. Understand the basic concepts of Machine Learning.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓					✓		
CO2			✓					
CO3	✓	✓						

CSEE XOX	**ADVANCED COMPUTER ARCHITECTURE**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the trends in computer architecture.
- To understand the various levels of parallelism.
- To understand the design challenges in building a computer system.

Classes of Computers - Defining Computer Architecture - Trends in Technology - Measuring, Reporting, and Summarizing Performance - Quantitative Principles of Computer Design. Memory Hierarchy Design – Introduction - Ten Advanced Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Crosscutting Issues: The Design of Memory Hierarchies.

Instruction-Level Parallelism: Concepts and Challenges - Basic Compiler Techniques for Exposing ILP - Reducing Branch Costs with Advanced Branch Prediction - Overcoming Data Hazards with Dynamic Scheduling - Dynamic Scheduling: Examples and the Algorithm - Hardware-Based Speculation -Exploiting ILP Using Multiple Issue and Static Scheduling - Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation - Advanced Techniques for Instruction Delivery and Speculation - Studies of the Limitations of ILP - Case Study.

Introduction - Vector Architecture - SIMD Instruction Set Extensions for Multimedia - Graphics Processing Units - Detecting and Enhancing Loop - Level Parallelism - Crosscutting Issues - Case Study.

Introduction - Centralized Shared-Memory Architectures - Performance of Symmetric Shared-Memory Multiprocessors - Distributed Shared-Memory and Directory-Based Coherence - Synchronization: The Basics - Models of Memory Consistency: An Introduction - Crosscutting Issues - Multicore Processors and Their Performance - Case Study.

Programming Models and Workloads for Warehouse-Scale Computers – Computer Architecture of Warehouse-Scale Computers – Physical Infrastructure and Costs of Warehouse-Scale Computers – Cloud Computing: The Return of Utility Computing – Crosscutting Issues – A Google Warehouse-Scale Computer – Case Study.

REFERENCES:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, Fifth edition, 2012.
2. Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", PHI, 2011.
3. Hwang, Kai, A. Ramachandran, and R. Purushothaman. Advanced computer architecture: parallelism, scalability, programmability. Vol. 199. New York: McGraw-Hill, 1993.

COURSE OUTCOMES:

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

1. Select the architecture appropriate for building state-of-the-art computer systems.
2. Comprehend the levels of parallelism to improve system performance.
3. Design computer systems to meet specific performance requirements.
4. Interpret the issues and challenges in hardware design.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓				✓	✓	
CO2		✓					✓	
CO3	✓	✓	✓			✓		✓
CO4	✓		✓			✓		

CSEE XOX	OBJECT ORIENTED MODELING AND DESIGN	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the basics of object-oriented modelling and design concepts
- To understand the UML design diagrams
- To learn various testing strategies
- Learn to develop applications using Object Oriented Programming Concepts
- Learn to solve a real world problems based on Object Oriented Principles

Object Oriented Systems Development – An introduction – Object Basics - Object Oriented Systems development life cycle – Object Oriented Methodologies – Booch Methodology – Object Modelling technique – Jacobson et al Methodologies.

Unified Modelling Language – Static and Dynamic Models – Need for Modelling – UML Diagrams – UML Class Diagrams – UML Object Diagrams – UML Interaction Diagrams – UML Sequence Diagram – UML Collaboration Diagram – UML State chart Diagram – UML Activity Diagram – UML Component Diagram- UML Deployment Diagram – Use case Diagrams.

Object Oriented Analysis – Identifying use cases – Object Analysis – Classifications Theory – Noun Phrase Approach – Common Class Patterns Approach – Use Case Driven Approach – Classes, Responsibilities and Collaborators – Identifying Object Relationships, attributes and methods.

Object Oriented Design Process – Object Oriented Design Axioms – Corollaries – Designing Classes – Designing Methods and Protocols – Access layer – Object store and persistence – Object Oriented Database Management Systems – Object Relational Systems – Multi database Systems.

Software Quality Assurance – Testing strategies – Impact of Object Orientation on testing – Test cases – Test plan – Debugging Principles – System Usability and Measuring user satisfaction – Object Oriented Design Metrics.

Case studies based on various Object Oriented Methodologies – Design of Foundation Class Libraries – Design of an Automated Teller Machine System – Modelling an Embedded System – Modelling a Client / Server System – Modelling a fully Distributed System.

REFERENCES:

1. Ali Bahrami, “Object Oriented Systems Development”, Irwin McGraw Hill, International Edition, 1999.
2. Rumbaugh J.,Blaha M., Premerlani W., et al, “Object Oriented Modelling and Design”, Prentice Hall, Engle wood Cliff, NJ., 1991.
3. Booch, “Object Oriented Analysis and Design with Applications”, II Edition, Benjamin Cummings, California, USA, 1994.

4. Coad, P. and Yourdon E., "Object Oriented Analysis", II Edition, Englewood Cliff, NJ, Yourdon press, Prentice Hall, 1991.
5. Jocobson I, Christerson M, Jonsson P and Ovesrgaard, "Object Oriented Software Engineering – A Use Case Driven Approach", Addison Wesley, 1992.
6. Dennus de Champeaux et. al., "Object Oriented System Development", Addison Wesley, 1993.

COURSE OUTCOMES:

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

1. Analyze and design a computer program based on Object Oriented Principles
2. Design and implement projects using OO concepts
3. Apply appropriate design patterns and create code from design
4. Solve a real world problems based on Object Oriented Principles
5. Implement features of object oriented programming to solve real world problems

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓						✓	✓
CO2	✓		✓	✓	✓	✓		
CO3		✓			✓	✓	✓	✓
CO4	✓	✓						
CO5	✓		✓	✓				✓

CSEE XOX	**REAL TIME SYSTEM CONCEPTS**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To study issues related to the design and analysis of systems with Real-time constraints
- To learn the features of Real time operating system.
- To study the various Uniprocessor and Multiprocessor scheduling mechanisms.
- To learn about various real time communication protocols.
- To study the difference between traditional and Real-time databases

Introduction to Real-time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics - Prediction of Execution Time : Source

code analysis, Micro-architecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems

Real time OS – Threads and Tasks – Structure of Microkernel – Time services – Scheduling Mechanisms Communication and Synchronization – Event Notification and Software interrupt

Task assignment and Scheduling - Task allocation algorithms -Single-processor and Multiprocessor task scheduling - Clock-driven and priority-based scheduling algorithms- Fault tolerant scheduling

Real-time Communication -Network topologies and architecture issues – protocols – contention based, token based, polled bus, deadline based protocol, Fault tolerant routing. Real-time Transport Protocol (RTP) and RTP Control Protocol (RTCP).

Real-time Databases – Transaction priorities – Concurrency control issues – Disk scheduling algorithms – Two phase approach to improve predictability.

REFERENCES:

1. C.M. Krishna, Kang G. Shin – " Real Time Systems", International Edition, McGraw Hill Companies, Inc., New York, 1997.
2. Jane W.S. Liu, Real-Time Systems, Pearson Education India, 2000.
3. Philip A. Laplante and Seppo J. Ovaska, "Real-Time Systems Design and Analysis: Tools for the Practitioner'' IV Edition IEEE Press, Wiley. 2011.
4. Rajib Mall, "Real –Time System: Theory and Practice." Pearson, 2008.

COURSE OUTCOMES:

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

1. Understand about Schedule ability analysis
2. Learn Real-time programming environments
3. Know about real time communication and databases
4. Develop real time systems

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓		✓			✓	
CO2	✓	✓	✓					
CO3	✓	✓			✓		✓	
CO4	✓		✓					

CSEE XOX	DATA MINING AND WAREHOUSING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To Understand Data mining principles and techniques
- To study the overview of Visualization and Statistical Perspectives and clustering techniques in details for better organization and retrieval of data
- To understand the concept of Predictive Modelling for the retrieval purposes
- To expose the students to the concepts of Data warehousing Architecture and Implementation
- To identify 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.

Data Warehousing - Design – Dimensional Modelling – Meta data – Performance issues and indexing – VLDB issues – Development life cycle – merits.

Applications - Tools – Applications – Case studies.

REFERENCES:

1. Usama M.Fayyad, Gregory Piatetsky – Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, "Advances in Knowledge Discovery and Data Mining", The M.I.T. 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. Sean Kelly, "Data Warehousing in Action", John Wiley & Sons Inc., 1997.
5. 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.
6. Bruce Ratner, "Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data", CRC Press, Second Edition, 2011.
7. Mehmed kantardzic, "Data mining concepts, models, methods, and algorithms", Wiley-Interscience, IEEE Press, 2nd Edition, 2003.

8. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, Tenth Reprint, 2007.
9. George M Marakas, "Modern Data Warehousing, Mining and Visualization", Prentice Hall, Second Edition, 2003.

COURSE OUTCOMES:

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

1. Learn about the fundamentals of data mining
2. Discover the knowledge imbibed in the high dimensional system
3. Cluster the high dimensional data for better organization of the data
4. Apply the Predictive Modelling techniques for mining the data
5. Study the various mining applications and tools

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2			✓					
CO3						✓		
CO4		✓						
CO5	✓							

CSEE XOX	**DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the need for parallel computers and algorithms
- To learn different models of parallel computation
- To expose the students to parallel sorting, merging, searching, matrix, graph theory and combinatorial problems and solve using parallel algorithms
- To become aware of various parallel programming models
- To analyze parallel algorithms

Introduction to Parallel Computers: A Model of Serial Computation - The Need for Parallel Computers - Models of Parallel Computation – SISD, SIMD, MISD, MIMD – Processor Organizations - Analysing Algorithms - Expressing Algorithms - Simple PRAM Algorithms –

Parallel Reduction, Prefix Sums – Parallel Programming Models: MPI, Shared Memory, Message Passing.

Designing Parallel Algorithms: SIMD Algorithms – MIMD Algorithms - Selection: Desirable Properties for Parallel Algorithms - Parallel Algorithm for Selection - Searching: Searching a Sorted Sequence – Searching a Random Sequence.

Merging: Merging on the EREW and CREW Models - Fast Merging on EREW – Sorting : Sorting Networks – Sorting on a Linear Array – Sorting on CRCW, CREW, EREW Models.

Matrix Operations: Matrix Transposition – Matrix by Matrix Multiplication – Matrix by Vector multiplication.

Graph Theory: Connectivity Matrix – Connected Components – All Pairs Shortest Paths – Minimum Spanning Trees – Combinatorial Problems : Sequential Tree Traversal - Basic Design Principles – Algorithm – Analysis.

REFERENCES:

1. Selim G. Akl, " he Design and Analysis of Parallel Algorithms", Prentice Hall, New Jersey, 1989.
2. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, 2003.
3. Michael J. Quinn, "Designing Efficient Algorithms for Parallel Computers", Tata McGraw Hill Edition, 1987.
4. S. Lakshmivarahan and S. K. Dhall, "Analysis and Design of Parallel Algorithms - Arithmetic and Matrix Problems", McGraw Hill, 1990.
5. V. Rajaraman and C. Siva Ram Murthy, "Parallel Computers – Architecture and Programming", PHI, New Delhi, 2003.
6. Justin R. Smith, "The Design and Analysis of Parallel Algorithms", Oxford University Press, USA, 1993.
5. Joseph JaJa, "Introduction to Parallel Algorithms"**,** Addison-Wesley, 1992.

COURSE OUTCOMES:

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

1. Realize the need for parallel computers and algorithms
2. Classify the parallel architectures
3. Design parallel algorithms for a given application.
4. Identify and implement suitable programming models for a given problem
5. Analyze the parallel algorithm.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2		✓						
CO3			✓					
CO4						✓		
CO5	✓							

CSEE XOX	**ADVANCED SYSTEM SOFTWARE**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of system software, compiler design and code generation
- To acquire the depth knowledge in parsers, macro processors and assemblers
- To learn the basic automata theory to generate a lexical analyzer
- To implement the optimization techniques for designing a code generator

Introduction: Overview of System Software and machine architecture – Assemblers – One pass assemblers - Multi pass assemblers - Loaders – Linkers - Macro processors – Their Features and Functions

.

Compilers: Basic compiler functions - Grammars - Lexical Analysis - Syntactic Analysis - Code generation - Parts of a compiler - Role of a lexical analyzer - Specification and recognition of tokens - Finite automata - Regular expression to finite automation - Use of a tool for generating lexical analyzer - Context free grammars - Role of a parser - Top-down and Bottom-up parsing.

Intermediate code generation: Intermediate languages - Declaration - Assignment statements - Boolean Expressions - Flow control statements - Back patching - Optimization techniques in code generation - Design issues - Run time storage management - Design of a simple code generator.

Virtual Machines: Introduction to Virtual Machines (VM) - Interpretation and binary translation - Process Virtual Machines - Emulation - Profiling - Migration - Grids - Pascal P-Code VM - Object oriented VMs - Java VM architecture - Common Language infrastructure - Dynamic class loading - Security - Garbage collection - Optimization.

Code optimization techniques: Procedure and memory hierarchy optimization - In-line expansion - Shrink wrapping - Code scheduling - Instruction scheduling - Speculative scheduling - Trace

scheduling - Register allocation and assignment – Graph coloring - Data flow analysis - alias analysis - Software pipelining - Run time support - Register usage - Code sharing - Position independent code - Examples of real world implementation of system software.

REFERENCES:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", Addison Wesley Publishing Company, 1988.
2. Lenand L. Beck, D. Manjula, "System Software: An Introduction to Systems Programming", Third Edition, Pearson Education Inc., 2012.
3. Robert W. Sebesta, "Concepts of Programming Languages", 7th Edition, Pearson Education, 2006.
4. James E. Smith, Ravi Nair, "Virtual Machines", Elsevier Publications, 2005.
5. Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman Publishers, Academic Press,1997.
6. Allen I. Holub, "Compiler Design in C", Prentice Hall of India, 1993.
7. Silberschatz, Galvin, Gagne, "Operating System Concepts", 6th Edition, Wiley, 2003.
8. Terrance W. Pratt, Marvin V. Zelkowitz, T.V.Gopal, "Programming Languages", 4th Edition, Pearson Education, 2006.
9. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, McGraw Hill, 2002.

COURSE OUTCOMES:

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

1. Acquire knowledge of assemblers, compilers, linkers and loaders
2. Understand the virtual machines and their architecture
3. Implement the optimization of system software code for real world applications
4. Design lexical analyzer using appropriate tool and a simple code generator

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓					✓		
CO2			✓					
CO3				✓				
CO4		✓	✓	✓				

CSEE XOX	NETWORK AND INFORMATION SECURITY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of information security
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- Analyze key terms and critical concepts of information security
- To understand the fundamentals of Cryptography

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. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2nd Edition
3. Principles of Information Security: Michael E. Whitman, Herbert J. Mattord, CENGAGE Learning, 4th Edition.
4. Network Security and Cryptography, Menezes Bernard, Cengage Learning, New Delhi, 2011.
5. Jason Andress: The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice, Elsevier, 2011

6. Matt Bishop, "Computer Security art and science", Second Edition, Pearson Education, 2002.
7. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007.
8. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007.
9. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006

COURSE OUTCOMES:

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

1. Realize basic security algorithms for a computing system.
2. Analyze the vulnerabilities in any computing system and consequently be capable to design a security justification.
3. Recognize the security issues in the network and resolve it.
4. Evaluate security means using exact approaches, together with theoretical root, modeling, and simulations

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓						
CO2	✓			✓		✓		
CO3		✓				✓		
CO4			✓		✓		✓	

CSEE XOX	**DESIGN OF EMBEDDED CONTROL SYSTEM**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To expose the students about the fundamentals of Embedded System
- To impart the knowledge in RTOS based Embedded System Design
- To educate about Firmware design and development
- To discuss on aspects required in Embedded system design techniques
- To state the real time applications with case studies

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 to basic concepts of RTOS- Types of Operating sytems, Tasks, Process and Threads, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-Task synchronization between processes-semaphores-Devices driver- Selection of RTOS-Comparison of Realtime Operating systems: VxWorks, чC/OS-II, RT Linux.

Design methodologies, Design Flows-Requirement analysis-Specifications-Control-Oriented Specification languages, Advanced Specifications- System analysis and Architecture design-CRC Cards-Quality Assurance-Quality assurance Techniques, Verifying the specifications, Design reviews, Measurement-driven quality assurance.

Elevator Controller – Battery Operated Smartcard Reader- Automated Meter Reading system-Digital Camera.

REFERENCES:

1. Shibu K.V, "Introduction to Embedded System", Tata McGraw-Hill,2014..
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. Shibu K.V, "C++ and Java for Embedded Development", 2009.
5. Steve Heath, "Embedded Systems Design" (2ED), Newnes/An imprint of Elsevier, 2005.
6. Franz Rammig, "Basic Concepts of Real Time Operating Systems", Springer Science + Business Media B.V. 2009.

COURSE OUTCOMES:

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

1. Recognize the key features of embedded systems in terms of computer hardware and be able to discuss their functions.
2. Aware of the key factors in embedded system design and development.
3. Explain the special extra-functional that are imposed on embedded systems.
4. Explain the basic operation of a real-time operating system.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1		✓			✓			
CO2	✓		✓	✓			✓	
CO3				✓				
CO4			✓			✓		✓

CSEE XOX	**SOFTWARE PROJECT MANAGEMENT**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the requirement collection process for developing a software
- To learn the leadership qualities to manage peoples in an organization
- To understand the risk management for successful project completion

Project definition - Contract management - Activities covered by software project management - Overview of Project planning - Stepwise project planning - Decision making - Leadership - Organizational structures.

Strategic assessment - Technical assessment - Cost benefit analysis - Cash flow forecasting - Cost benefit evaluation techniques - Risk evaluation - Risk management - Risk planning and control.

Objectives - Project schedule - Sequencing and scheduling activities - Network planning models - Forward pass - Backward pass - Activity float - Shortening project duration - Activity on arrow networks.

Creating framework - Collecting the data - Visualizing progress - Cost monitoring - Earned value - Prioritizing - Getting project back to target - Change control - Managing contracts - Introduction - Types of contract - Stages in contract placement - Typical terms of a contract.

Introduction - Understanding behavior - Organizational behavior - background - Selecting the right person for the job - Instruction in the best methods – Motivation - Hackman job characteristics model - Working in groups.

REFERENCES:

1. Bob Hughes, Mike cotterell, Software Project Management, Tata McGraw Hill, 2008.
2. Watts S.Humphrey, Managing the Software Process, Pearson Education, 2011.

3. Ramesh, Gopalaswamy, Managing Global Projects, Tata McGraw Hill, 2006.
4. Pankaj Jalote, Software Project Management in Practice, Pearson Education, 2002.
5. Neal Whitten, "Managing Software Development Projects, Formula for success", John Wiley & Sons, Inc., 1995.
6. Robert K. Wysocki, "Executive's Guide to Project Management", John Wiley & Sons, 2011.

COURSE OUTCOMES:

1. Understand project management activities and steps in Project Planning.
2. Create an effective cost estimation technique that suits all types of projects.
3. Design framework for Risk Management.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2		✓						
CO3				✓	✓			

CSEE XOX	**ADVANCED NATURAL LANGUAGE PROCESSING**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To provide an introduction to the central issues of Natural Language Processing (NLP) in relation to linguistics and statistics.
- To understand the fundamentals of word structure and parts-of-speech tagging.
- To understand the basics of speech sounds and speech recognition models.
- To recognize the applications of NLP such as question answering, summarization, document categorization and machine translation techniques.

Introduction: Knowledge in speech and language processing: Phonetics and phonology-Morphology – Syntax – Semantics – Pragmatics – Discourse – Ambiguity – Models and algorithms – Language understanding – Language generation – Language typology-Language Corpora – Corpus analysis - Language modeling.

Words: Regular expressions and automata – Morphology and Finite-State transducers -FSTs for morphological parsing - Human morphological processing – N-Grams – Word classes and part of speech tagging: Part-of-Speech tagging –Rule based tagging – Hidden Markov Model – Transformation based tagging-Evaluating taggers.

Phonetics: Speech sounds and phonetic transcription – Articulatory phonetics– Computational phonology: Syllabification – Learning phonology and morphology-Speech synthesis: Text normalization – Phonetic analysis – Prosodic analysis – Automatic speech recognition: Speech recognition architecture – Applying the hidden Markov model to speech.

Formal grammars of English: Grammar rules – Tree banks - Parsing with context-free grammars: Dynamic programming parsing methods– Statistical parsing – Features and unification: Feature structures – Unification of feature structures – Computational semantics: Syntax driven semantic analysis – Lexical semantics: WordNet – Internal Structure of words-Metaphor.

Applications: Information retrieval – Factoid question answering – Summarization – Multi-document Summarization – Evaluating Information retrieval systems – Document categorization – Machine Translation: Transfer metaphor – Interlingua – direct translation and statistical techniques.

REFERENCES:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Second Edition, Pearson Higher Education, 2009.
2. Daniel Bikel and ImedZitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, IBM Press, 2012.
3. David A. Grossman and OphirFedier, Information Retrieval: Algorithms and Heuristics (The Information Retrieval Series), Springer, 2004.
4. Michael W Berry, Survey of Text Mining I: Clustering, Classification and Retrieval, Copyrighted material, Springer, 2013.
5. James Allen, Natural Language Understanding, 2nd edition, Benjamin/Cummings publishing company, 1995.
6. Manning, Christopher D. and Hinrich Schütze, Foundations of Statistical Natural Language Processing. Cambridge, MA: MIT Press, 1999. ISBN: 0262133601
7. Daniel Jurafsky and James H Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2nd Edition, Prentice Hall, 2008.

COURSE OUTCOMES:

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

1. Attain fundamental knowledge in natural language processing.
2. Describe the methods for morphological analysis and parts of speech tagging.
3. Familiarize with techniques used for speech recognition.
4. Acquire knowledge on linguistic information using parsing techniques.
5. Gain comprehensive knowledge on applications of NLP

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2							✓	
CO3				✓				
CO4								✓
CO5			✓		✓			

CSEE XOX	**MOBILE ADHOC NETWORKS**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of Ad Hoc Network architecture, Protocols, Issues
- To introduce the various types of Ad Hoc routing protocols
- To provide in-depth knowledge about Sensor Network Architecture, its Applications and MAC Protocols for sensor networks.
- To elucidate issues in WSN routing, Indoor and outdoor Localization and Quality of Service in WSN
- To emphasize on Necessity for Mesh Networks , IEEE 802.11s Architecture and different types of Mesh Networks

AD-HOC- Introduction – Issues in Ad-Hoc 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. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, Ad Hoc TCP, and Split TCP.

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, Second Edition,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, the students will be able to

1. Understand knowledge of Ad Hoc networking basics and Architecture.
2. Implement Ad hoc routing protocols and analyzing the performances of Protocols.
3. Understand Wireless sensor networks basics and routing methods..
4. Design and implement the Mesh networks with MAC enhancements.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓					✓	
CO2			✓					
CO3					✓			
CO4			✓			✓		

CSEE XOX	**SOFTWARE QUALITY AND TESTING**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To impart the fundamental knowledge of testing and quality assurance.
- To introduce the various techniques for testing.
- To introduce the concepts and significance of quality and quality assurance
- To explain the procedures for quality planning and assessment

Basic Concepts and Preliminaries: Quality Revolution - Software Quality-Role Of Testing-Verification and Validation - Failure ,Error, Fault, and defect-Notion of software Reliability - objective of testing-What Is the test case - Expected Outcome - Central Issues Of testing - Testing Activities-Test Levels-White Box and Black Box Testing Test Planning and Design - Test Tools and Automation.

Theory of Program testing: Basic Concepts in Testing Theory - Theory of Good Enough And Gerhant -Theory of Weyuker and Ostrand -Theory of Gourlay - Adequacy of Testing-Limitations of Testing. System test design - System test planning and automation.

Unit Testing: Concepts Of unit Testing - Static Unit Testing-Defect Prevention - Dynamic unit testing-mutation testing - Debugging. Control Flow Testing: Basic Idea of Control Flow Testing - Control flow Graph - Paths in control Flow graph - Path Selection Criteria - Generating test input-Example of Test data Selection - Containing infeasible Paths. Data Flow Testing: Overview of Dynamic Data Flow Testing -Data flow graph - Data Flow Terms. Domain Testing: Domain Error - Testing For domain error - Sources of domains - Types of Domain error. System Integration Testing-Concepts Of integration Testing-different Types of Interfaces and Interface error - System integration Techniques - H/W and S/W integration. Functional testing.

Software Quality: Perspectives and Expectations - Quality frameworks and ISO-9126 - Correctness and Defects: Definition, properties and Measurements - A Historical perspective of Quality. Quality Assurance: Classification-Defect Prevention - Defect Reduction-Defect Containment. Quality assurance in context: Handling Discovered Defects during QA Activities - QA Activities in Software Processes -Verification and validation Perspectives.

Quality Engineering: Activities and Processes. Quality Planning: Goal setting and Strategy Formation. Quality Assessment and improvement, Quality Engineering in Software process

REFERENCES:

1. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance", John Wiley& Sons, Publication 2008.
2. Jeff Tian, "Software Quality Engineering Testing, a Quality Assurance, and Quantifiable Improvement", John Wiley and Sons Publication 2005.
3. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van No strand Reinhold, New York, 1993.
4. K.K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International Publishers, New Delhi, 20053. Boris Beizer, "Software Testing Techniques", Second Edition, Wiley - Dreamtech India, New Delhi, 2003.
5. Boris Beizer , "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.

COURSE OUTCOMES:

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

1. Apply modern software testing processes in relation to software development and project management.
2. Create test strategies and plans, design test cases, prioritize and execute them.
3. Ensure quality and efficient delivery of software solutions and implement improvements in the software development processes

4. Gain expertise in testing and quality assurance activities in the context of development of computer based systems and IT processes

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓	✓			✓		
CO2	✓	✓		✓	✓			
CO3			✓	✓		✓	✓	
CO4			✓				✓	✓

CSEE XOX	**DIGITAL STEGANOGRAPHY AND WATERMARKING**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the basic principles and different types of steganography
- To make them understand the steganalysis
- To provide the basic knowledge of various methods in watermarking
- To know the current watermarking techniques
- To understand the types of watermarking and optimization techniques

Introduction to Information hiding – Brief history and applications of information hiding - Principles of Steganography – Frameworks for secret communication – Security of Steganography systems – Information hiding in noisy data – Adaptive versus non-Adaptive Algorithms – Active and Malicious Attackers – Information hiding in written - Examples of Invisible communications.

Stegnographic techniques – Substitution system and bit plane tools – Transform domain techniques – Spread spectrum and information hiding – Statistical Steganography – Distortion and cover generation techniques.

Overview of steganalysis- Statistical Properties of Images - Visual Steganalytic System -IQM-Based Steganalytic System - Learning Strategies - Frequency-Domain Steganalytic System. Looking for Signatures: Detecting Hidden Information - Extracting Hidden Information - Disabling Hidden Information

Introduction -History and Terminology - Basic Watermarking Principles - Watermarking Applications - Requirements and Algorithmic Design Issues: Imperceptibility, Robustness, Watermark Recovery with or without the Original Data, Watermark Extraction or Verification of Presence for a Given Watermark, Watermark Security and Keys - Evaluation and Benchmarking of Watermarking Systems

Cryptographic and psycho visual aspects – Choice of a workspace – Formatting the watermark bits – Merging the watermark and the cover – Optimization of the watermark receiver – Extension from still images to video- Fingerprinting: Introduction – Examples, Terminology and Requirements, Classification, Research History, Schemes - Digital Copyright and Watermarking - Conflict of Copyright Laws on the Internet

REFERENCES:

1. Stefan Katzenbelsser and Fabien A. P. Petitcolas, "Information Hiding Techniques for Steganography and Digital Watermarking", Artech House Publishers, 2004.
2. Frank Y. Shih, "Digital Watermarking and Steganography: fundamentals and techniques", CRC Press, 2007.
3. Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge University Press, 2010.
4. Abbas Cheddad, Vdm Verlag and Dr. Muller, "Digital Image Steganography: Concepts, Algorithms and Applications", Aktienge sells Chaft & Co. Kg, 2009.
5. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich and Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, 2007.

COURSE OUTCOMES:

1. Develop skill to make and implement a simple Steganographic technique
2. Distinguish between Watermarking and Steganography techniques
3. Select the suitable steganography method to develop a new project.
4. Understand the existing digital watermarking techniques and formulate new ideas
5. Have a detailed knowledge of the watermarking techniques

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓	✓					
CO2	✓		✓					
CO3		✓	✓	✓		✓		
CO4	✓					✓		
CO5	✓	✓	✓					

CSEE XOX	**SPEECH AND AUDIO SIGNAL PROCESSING**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To understand the basic mechanism of speech production and auditory perception.
- To learn the basic concepts of time and frequency domain analysis of speech signal.

- To explain the various parametric representation of speech.
- To acquire knowledge on 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. L. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", Prentice Hall
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.
6. Meinard Muller, "Fundamentals of Music Processing – Audio, Analysis, Algorithms, Applications", Springer International Publishing, 2015.
7. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
8. Dr. Shaila D. Apte," Speech and Audio Processing",John Wiley-India, 2012.

COURSE OUTCOMES:

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

1. Acquired knowledge of speech production and auditory perception
2. Understand the time and frequency domain analysis of speech.
3. Acquired knowledge on various parameters of speech.
4. Ability to develop systems for various applications of speech processing.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2	✓							
CO3			✓					
CO4		✓						✓

		L	**T**	**P**
CSEE XOX	**IMAGE MINING AND REPOSITORY**	4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of image retrieval and image databases.
- To introduce different features and extraction methods
- To explain the various clustering and classification techniques
- To understand various distance measures and performance measures.

Annotation based image retrieval. Content Based Image Retrieval (CBIR): CBIR architectures; Region-based retrieval, Semantic-based retrieval, Context-based retrieval, Relevance Feedback. Types of image databases; Image Features. Image Clustering; Classification; Matching; Indexing.

Structured image databases, textured image database; image properties; Feature vector database. Image Features: colour based; colour models, texture based, shape based, spatial orientation. Edge and boundary based features.

Statistical methods: mean, variance, covariance, coefficient of variation, mean vector, covariance matrix, correlation, regression, co-occurrence matrix, Eigen vector. Histogram bins

Clustering: k-means algorithm, c-means algorithm, fuzzy c-means, kNN method, Branch and Bound method, Graph theoretic approach.Classification:Bayes classifier, Quadratic classifier.

Point-wise measures: Euclidean distance, Manhattan distance, Canberra distance; Distributional measures: Bhattacharyya distance, Mahalanobis distance, Kullback-Liebler distance, Chi-squared distance, Chebychev. Measure of performance: Precision, recall; F measures.

REFERENCES:

1. Keinosuke Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Ed., Academic Press, Inc., New York, 1990.
2. Oge Marques and Borko Furht, Content-Based Image and Video Image Retrieval, Kuluwar Academic Publisher, USA, 2002.
3. Sagarmay Deb, Multimedia Systems and Content-Based Image Retrieval, IDEA Group Publishing, USA, 2004.
4. Jiawei Han, Micheline Kamber, and Jian Pei, Data Mining: Concepts and techniques, Third Ed., Elsevier, 2011.

COURSE OUTCOMES:

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

1. Acquire knowledge about various image retrieval systems.
2. Analyze different image databases and its uses.
3. Understand the different feature sets and its extraction methods.
4. Implement various classification and clustering algorithms.
5. Analyze different distance measures and performance measures.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓							
CO2		✓					✓	
CO3		✓						
CO4	✓		✓		✓		✓	
CO5					✓	✓		

CSEE XOX	MEDICAL IMAGE PROCESSING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To study about medical image fundamentals
- To acquire knowledge in medical image storage and enhancement techniques
- To provide an up-to-date background in current state-of-the-art in medical imaging and applications of computational tools for medicine.

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, Volume 2. Medical Image Processing and Analysis", 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, the students will be able to

1. Acquire depth knowledge about the various medical image processing techniques
2. Attain practical knowledge in medical Imaging .
3. Perform research works in the area of medical imaging
4. Gain knowledge about how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	✓	✓					
CO2			✓	✓				✓
CO3				✓				✓
CO4			✓		✓	✓	✓	

CSEE XOX	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES:

- To formulate and solve optimization problems
- To understand linear and non-linear programming problems
- To study the applications of optimization in engineering

Engineering Applications - Classification of optimization problems - Classical optimization techniques - Single & multivariable optimization - multivariable

optimization with & without constraints - Saddle point - Solution by the method of Lagrange multipliers - Kuhn - Tucker conditions.

Applications - Standard form of LPP - definitions & Theorem - Solution of a system of Linear simultaneous equations - Pivoted reduction - Simplex algorithm - Identifying an optimal point - Revised simplex methods - Gauss Jordan Elimination process - Duality in linear programming - Decomposition principle - Transportation problem - Northwest corner rule - Least cost method

Nonlinear programming - one dimensional minimization methods - unrestricted search - Exhaustive search - Interpolation methods - Quadratic interpolation method - Cubic method - unconstrained optimization techniques -Direct search methods - simplex method - Descent methods - Gradient of a function - Steepest Descent method - Constrained optimization techniques - Transformation techniques - penalty function methods or sequential unconstrained minimization techniques (SUMT) - Interior and exterior penalty function method - Extrapolation technique.

Geometric programming - Polynomial - Unconstrained minimization problem - Constrained minimization problem - Primal and Dual programmes – Geometric programming with mixed inequality constraints – Complementary geometric programming .

Integer linear programming – Mixed integer programming – Integer non linear programming – Sequential linear discrete programming.

Dynamic programming: Multistage decision processes – Concept of sub optimization – Principle of optimality – Conversion of a final value problem into an initial value problem – Linear programming as a case of dynamic programming – Continuous dynamic programming – Applications.

REFERENCES:

1. Rao S.S, “Optimization Theory and applications”, Wiley Eastern Ltd, Second Edition, 2000
2. Bevridge G.S.G and Schechter R.S, “ Optimization Theory and practice”, McGraw Hill, 1969
3. Hadley G, “Nonlinear and dynamic programming”, Addison-Wesley, 1990.
4. Dorfman R, Samuelson P. and Solow R, “Linear programming and economic analysis”, McGraw Hill, 1958
5. Fax R.L, “Optimization methods for engineering design”, Addison- Wesley, 1971.
6. Rao S.S, “Engineering Optimization Theory & Practice”, Third Edition New Age International, 1998.
7. Srinath L.S, “Linear programming principles & Application”, Affiliated East West Press, 1984.

COURSE OUTCOMES:

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

1. Understand the importance of optimization.
2. Apply basic concepts of mathematics to formulate an optimization problem.
3. Analyze performance measures of optimization problems.
4. Know the optimized ways in engineering.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1						✓		
CO2	✓	✓						
CO3								
CO4	✓	✓					✓	

CSEE XOX	**WIRELESS SENSOR NETWORKS**	**L**	**T**	**P**
		4	0	0

COURSE OBJECTIVES :

- To study the concepts of wireless sensor networks
- To study the concepts of physical layer
- To understand the concepts of data link layer
- To understand the concept of routing
- To study the concepts of TimyOS

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc networks, single node architecture-Hardware components, energy consumption of sensor nodes, network architecture-sensor network scenarios ,types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks

Introduction, wireless channel and communication fundamentals-frequency allocation, modulation and demodulation, wave propagation effects and noise, channel models, spread spectrum communication, packet transmission and synchronization ,quality of wireless channels and measures for improvement, physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, power management.

MAC protocols-fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, Contention-based protocols, schedule-based protocols - SMAC,BMAC, Traffic-adaptive medium access protocol(TRAMA), link layer protocols-fundamentals task and requirements, error control, Framing ,link management.

Macro MOTE, Routing, Security, Energy aware routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Data-centric routing- SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing-COUGAR, ACQUIRE, Hierarchical routing-LEACH, PEGASIS, Location based routing- GAF, GEAR, Data aggregation- Various aggregation techniques.

Target detection tracking, Habitat monitoring, Environmental disaster monitoring, practical implementation issues, IEEE 802.15.4, low rate WPAN, Operating system Design issues, Introduction to TinyOS – NesC, interfaces, modules, configuration, Programming in TinyOS using NesC, Emulator TOSSIM.

REFERENCES:

1. KazemSohraby, Daniel Minoli and TaiebZnati, " Wireless sensor Networks Technology-Protocols and Applications", Johnwiley& Sons, 2007.
2. Feng Zhao, Leonidas Guibas, " Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
3. C.S.Raghavendra Krishna, M.Sivalingam and TaribZnati, " Wireless Sensor Networks ", Springer publication, 2004.
4. Holger Karl, Andreas Willig, " Protocol and Architecture for Wireless Sensor Networks ", John wiley publication, Jan 2006.
5. PiotrSzczechowiak, " Security in Wireless Sensor Networks", Lambert Academic publishing , May 2011.
6. Philip Levis and David Gay, " Tiny OS Programming", Cambridge University Press; first edition, March 2009.

COURSE OUTCOMES:

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

1. Get a complete knowledge about wireless sensor networks
2. Get knowledge about all layers
3. Get the practical implementation issues

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1								✓
CO2	✓							
CO3		✓						

CSEE XOX	DIGITAL VIDEO PROCESSING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To provide the students with a basic understanding of the theory behind various video processing tasks.
- To learn the most popular and successful algorithms to solve video processing problems.

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-Intra Prediction -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, the student should be able to

1. Demonstrate sufficient understanding of video processing including video representation, video filtering and video compression.
2. Demonstrate the program basic video processing operations using the MATLAB.
3. Demonstrate a complete video processing system to achieve a specific task and analyze and interpret the system.

Mapping with Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓						✓	
CO2			✓		✓		✓	
CO3		✓						✓

OPEN ELECTIVES

CSEE XOX	BIG DATA ANALYTICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand several key big data technologies used for storage, analysis and manipulation of data.
- To recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, Hadoop Ecosystem, R, and NoSQL.
- To prepare a sample big data project.

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. David Hand, Heiki Mannila, Padhria Smyth, "Principles of Data Mining", PHI 2013
6. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
7. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.
8. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
9. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition, 2010.
10. Jared Dean, "Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners", Wiley India Private Limited, 2014.
11. http://hadoop.apache.org/
12. https://www.tutorialspoint.com/
13. http://www.coreservlets.com/hadoop-tutorial/

COURSE OUTCOMES:

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

1. categorize and summarize big data and its importance.
2. differentiate various big data technologies like Hadoop, MapReduce, Hadoop Ecosystem, R, and No-SQL.
3. apply tools and techniques to analyze big data.
4. earn tips and tricks for big data use cases and solutions.

CSEE XOX	CLOUD COMPUTING TECHNOLOGIES	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the concepts of cloud and utility computing
- To understand the various issues in cloud computing
- To familiarize themselves with the lead players in cloud
- To appreciate the emergence of cloud as the next generation computing paradigm
- To be able to set up a private cloud

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. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
5. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner‟s Guide”, McGraw-Hill Osborne Media, 2009.
6. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
7. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.

COURSE OUTCOMES:

At the end of this course, the student should be able to

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing
2. Identify the architecture, infrastructure and delivery models of cloud computing
3. Explain the core issues of cloud computing such as security, privacy and interoperability
4. Choose the appropriate technologies, algorithms and approaches for the related issues

CSEE XOX	WEARABLE COMPUTING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of wearable computing
- To introduce the Arduino software for wearable computing
- To understand the hardware and software requirements of Wearable computing

Arduino – Hardware hacking- How electricity works- Lilypad- Arduino Mini – Electronic components for soft prototyping

Arduino IDE – Installing the software – Using the IDE

Oft prototyping with LEDs – sewing a LED – soft push button – Hidden push button

The analog Zipper - Using an LDR - DC motors - servo motors

Oscillator with a Zipper - The soft synthesizer – Controlling a normal servo with a zipper - Touch sensitive embroidery - Coding - Basic Structure – variables – types – declarations – operators – loops.

REFERENCES:

1. Tony Olsson, David Gaetano, Jonas Odhner and Samson Wiklund, "Open softwear fashionable prototyping and wearable computing using the Arduino" First Edition,2008

COURSE OUTCOMES:

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

1. Acquire knowledge of wearable computing
2. Understand the usage of Arduino software and its IDE
3. Understand the operation of hardware involved
4. Able to write the coding using Arduino software

CSEE XOX	INTERNET OF THINGS (IoT)	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

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.

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 Arduino Projects for Linux Programmers", Apress, 2014.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.

COURSE OUTCOMES:

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

1. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
2. Develop web services to access/control IoT devices.
3. Deploy an IoT application and connect to the cloud.
4. Analyze applications of IoT in real time scenario

CSEE XOX	MULTIMEDIA SYSTEMS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand various aspects of multimedia
- To represent image, video and audio
- To acquire knowledge in multimedia compression
- To study input, output and storage technologies of multimedia
- To learn hypermedia messaging and synchronization

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases.

Types of compressions – Image Compression – Video compression –Audio compression – Data and file format standards – Multimedia data structures: KD Trees, R trees.

Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies.

Multimedia authoring − Hypermedia messaging − Hypermedia message component − Creating hypermedia messages − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.

Multimedia communication systems – Data base systems – User interfaces – Notion of Synchronization – Presentation requirements –Synchronization specification – Multimedia Applications.

REFERENCES:

1. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2008
2. Ralf Steinmetz, Kerla Neshtudt, "Multimedia: Computing, Communications and Applications", Pearson Education, 2012
3. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 2007.
4. Ze-Nian Li, Mark S.Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Springer, 2014.
5. Yun Q. Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards", CRC Press, 2008.
6. Tay Vaughan, "Multimedia: Making it Work", McGraw Hill Publication, 2010.

COURSE OUTCOMES:

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

1. Acquire knowledge of different media streams in multimedia.
2. Compress image, video and audio.
3. Select suitable file formats and data structures.
4. Design user interfaces and develop interactive multimedia applications.

CSEE XOX	ADVANCED WEB DESIGN	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the issues in the design of web application development
- To learn the concepts of client side and server side technologies, three tier application using MVC and software components using EJB
- To understand and learn the importance of java based security solutions
- To learn the concept of frameworks

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 - Need for 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 Enginering 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, the students will be able to

1. 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. Develop web services using J2EE and related technologies.

CSEE XOX	INTERNET PROGRAMMING TOOLS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn about Java, HTML, DHTML concepts
- To know about server side programming
- Knowledge of XML and its applications

History of internet-Internet addressing-TCP/IP-DNS and directory services-Internet Applications-Electronic mail, New groups UUCP, FTP, Telnet, Finger.

Overview – Hyper text markup language- Uniform Resource Locators-Protocols-M Browsers-Plug-Ins-Net meeting and Chat-Search engines.

Java Script Programming-Dynamic HTML-Cascading style sheets-Object model and Event model- Filters and Transitions-Active X Controls-Multimedia-Client side script.

Introduction to Java Servlets – overview and architecture – Handling HTTP get & post request – session Tracking – Multi-tier application - Implicit objects – Scripting – Standard actions – Directives – Custom Tag libraries.

Connecting to Databases – JDBC principles – Database access – XML – Introduction – Structuring Data – XML Namespaces – XML vocabularies – Web server.

REFERENCES:

1. Deital, "Internet & World Wide Web, How To Program", Third edition, Pearson Education, 2004
2. Jame Jaworski, "Java 2 Platform Unleased", SAMS Techmedia Publications, 1999.
3. Herbert Schildt , "Java 2: Complete Reference", 5th edition, TMH,2002.
4. Deital & Deital, "Java How to program", Prentice hall, 2000.
5. Gary Cornell, Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems, 2008.
6. Ted coombs, Jason coombs , Don Brewer, " ActiveX Source book", Wiley, 1996.

COURSE OUTCOMES:

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

1. Understand the basic concepts of Internet programming and protocols used.
2. Create applications using HTML, DHTML, CSS and Java Script.
3. Develop applications using SERVLETS.
4. Work with JDBC, Web Databases and XML.

CSEE XOX	MOBILE APPLICATION DEVELOPMENT FRAMEWORK	L	T	P
		4	0	0

COURSE OBJECTIVES:

- Understand system requirements for Mobile Applications.
- Generate and implement suitable design using specific Mobile Development Frameworks.
- Convert existing web application into Mobile Applications with minimal effort.

Introduction to mobile applications - Embedded systems - Market and business drivers for mobile applications - Publishing and delivery of mobile applications - Requirements gathering and validation for mobile applications.

Introduction - Basics of embedded systems design - Embedded OS - Design constraints for mobile applications, both hardware and software related - Architecting mobile applications - User interfaces for mobile applications - touch events and gestures - Achieving quality constraints - performance, usability, security, availability and modifiability.

Designing applications with multimedia and web access capabilities - Integration with GPS and social media networking applications - Accessing applications hosted in a cloud computing environment - Design patterns for mobile applications.

Introduction - Establishing the development environment - Android architecture - Activities and views - Interacting with UI - Persisting data using SQLite - Packaging and deployment - Interaction with server side applications - Using Google Maps, GPS and Wifi - Integration with social media applications.

Introduction to iOS - iOS features - UI implementation - Touch frameworks - Data persistence using Core Data and SQLite - Location aware applications using Core Location and Map Kit - Integrating calendar and address book with social media application - Using Wifi - iPhone marketplace.

REFERENCES:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Dream Tech, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
4. Mahesh Panhale, “Beginning Hybrid Mobile Application Development”, Apress, 2016
5. Pradeep Kothari, “Android Application Development Black Book”, Dreamtech Press, 2014.
6. Mark Lassoff, “Mobile App Development with HTML5”, LearnToProgram, Incorporated, 2015

COURSE OUTCOMES:

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

1. Describe the requirements for Mobile Applications
2. Explain the challenges in Mobile Application design and development
3. Develop design for Mobile Applications for specific requirements
4. Deploy Mobile Applications in Android and iPhone marketplace for distribution

CSEE XOX	ADVANCED SOFT COMPUTING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To familiarize with soft computing concepts.
- To introduce the ideas of Neural networks, fuzzy logic and use of heuristics based on human experience.
- To introduce the concepts of Genetic algorithm and its applications to soft computing.
- To gain insight onto Neuro Fuzzy modeling and control.

Soft Computing : Introduction of soft computing, soft computing vs. hard computing,various types of soft computing techniques, applications of soft computing. Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets -fuzzy sets – crisp relations and fuzzy relations. Genetic algorithm: Introduction –biological background – traditional optimization and search techniques – Genetic basic concepts.

Supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations- Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions- Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle –stopping condition – constraints – classification genetic programming – multilevel optimization – real life problem- advances in GA.

Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

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5. David e. Goldberg, "Genetic algorithms in search, optimization and machine learning", Addison wesley, 2007.
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COURSE OUTCOMES:

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

1. Apply various soft computing frame works
2. Design of various neural networks
3. Use fuzzy logic
4. Apply genetic programming
5. Discuss hybrid soft computing

CSEE XOX	HUMAN COMPUTER INTERACTION	L	T	P
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COURSE OBJECTIVES:

- To learn the design techniques and fundamentals of Human Computer Interaction (HCI)
- To know the various types of existing interfaces and evaluation techniques
- To understand the applications of HCI in emerging trends

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 support systems.

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, the students will be able to

1. Understand the requirements and specifications for the interaction design.
2. Analyze the evaluation techniques of human interaction.
3. Able to design an efficient and user friendly human computer interface.
4. Determine the most appropriate HCI methods to meet the needs of a practical software development project.