ANNAMALAI UNIVERSITY

Annamalainagar

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

M.E. Information Technology

Two Year Degree Programme

Choice Based Credit System

(Full - Time)

HAND BOOK

2017 - 2018

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To produce globally competent, quality technocrats, to inculcate values of leadership and research qualities and to play a vital role in the socio – economic progress of the nation.

MISSION

- To partner with the University community to understand the information technology needs of faculty, staff and students
- To develop dynamic IT professionals with globally competitive learning experience by providing high class education
- To involve graduates in understanding need based Research activities and disseminate the knowledge to develop entrepreneur skills

M.E. (INFORMATION TECHNOLOGY)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. Engineers will practice the profession of engineering using a systems perspective and analyze, design, develop, optimize & implement engineering solutions and work productively as engineers, including supportive and leadership roles on multidisciplinary teams.
2. Continue their education in leading graduate programs in engineering & interdisciplinary areas to emerge as researchers, experts, educators & entrepreneurs and recognize the need for, and an ability to engage in continuing professional development and life-long learning.
3. Engineers, guided by the principles of sustainable development and global interconnectedness, will understand how engineering projects affect society and the environment.
4. Promote Design, Research, and implementation of products and services in the field of Engineering through Strong Communication and Entrepreneurial Skills.
5. Re-learn and innovate in ever-changing global economic and technological environments of the 21st century.

M.E. (INFORMATION TECHNOLOGY)
PROGRAMME OUTCOMES (PO)

After the successful completion of the M.E. (Information Technology) degree programme, the students will be able to:

PO1: Apply knowledge of computing, mathematical foundations, algorithmic principles, and engineering theory in the modelling and design of systems to real-world problems (fundamental engineering analysis skills).

PO2 : Apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline.

PO3: Design and conduct experiments, as well as to analyze and interpret data (information retrieval skills). Practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills.

PO4: Analyze a problem, identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution (engineering problem solving skills).

PO5: Understand the appropriate codes of practice and industry standards.

PO6: Identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques.

PO7: Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues.

PO8: Communicate effectively, both in writing and orally (speaking / writing skills).

PO9: Understand professional, ethical, legal, security and social issues and responsibilities (professional integrity).

PO10: Formulate and solve moderately complex engineering problems, accounting for hardware/software/human interactions.

Mapping PO with PEO										
PEOs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
PEO1	✓	✓	✓		✓		✓	✓	✓	✓
PEO2		✓			✓	✓				✓
PEO3			✓	✓		✓		✓		
PEO4	✓	✓	✓		✓			✓		✓
PEO5	✓		✓	✓		✓	✓		✓	

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.

ANNEXURE - 1

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

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme *
				Instrumentation Engg.
		iii.	Power System	B.E. / B.Tech – Electrical and Electronics Engg,
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

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme *
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 INFORMATION TECHNOLOGY

Curriculum for M.E. (INFORMATION TECHNOLOGY)

Full-Time

Sl. No.	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits
Semester – I										
1	PC-I	ITEC 101	Mathematics for Computing	4	-		25	75	100	3
2	PC-II	ITEC 102	Advanced Data Structures and Algorithm	4	-		25	75	100	3
3	PC-III	ITEC 103	Advanced Network Technology	4	-		25	75	100	3
4	PC-IV	ITEC 104	Integrated Software Engineering Methodology	4	-		25	75	100	3
5	PE-I	ITEE 105	Professional Elective-I	4	-		25	75	100	3
6	PE-II	ITEE 106	Professional Elective-II	4	-		25	75	100	3
7	PC Lab-I	ITEP 107	Advanced Data Structures and Networking Lab	-	-	3	40	60	100	2
			Total	**24**	**-**	**3**	**190**	**510**	**700**	**20**

Sl. No.	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits
Semester – II										
1	PC-V	ITEC 201	Advanced Operating Systems	4	-	-	25	75	100	3
2	PC-VI	ITEC 202	Multi-Core Architecture	4	-	-	25	75	100	3
3	PC-VII	ITEC 203	Big Data Analytics	4	-	-	25	75	100	3
4	PC-VIII	ITEC 204	Mobile and Pervasive Computing	4	-	-	25	75	100	3
5	PE-III	ITEE 205	Professional Elective-III	4	-	-	25	75	100	3
6	PE-IV	ITEE 206	Professional Elective-IV	4	-	-	25	75	100	3
7	PC Lab-II	ITEP 207	Big Data and Hadoop Lab	-	-	3	40	60	100	2
8	Seminar	ITES 208	Seminar		-	2	100	-	100	1
			Total	**24**	**-**	**5**	**290**	**510**	**800**	**21**

Sl. No.	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits
S e m e s t e r – III										
1	OE-I	ITEO 301	Open Elective – I	4	-	-	25	75	100	3
2	OE-II	ITEO 302	Open Elective – II	4	-	-	25	75	100	3
3	Thesis	ITET 303	Thesis Phase-I	-	4	-	40	60	100	4
4	Ind Train	ITEI 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	T	P	CA	FE	Total	Credits
S e m e s t e r – IV										
1	Thesis	ITET 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

DEPARTMENT OF INFORMATION TECHNOLOGY

Curriculum for M.E. (INFORMATION TECHNOLOGY)

Part-Time

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 – I											
1	PC-I	PITEC 101	Mathematics for Computing	4	-		25	75	100	3	ITEC 101
2	PC-II	PITEC 102	Advanced Data Structures and Algorithm	4	-		25	75	100	3	ITEC 102
3	PC-III	PITEC 103	Advanced Network Technology	4	-		25	75	100	3	ITEC 103
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

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 – II											
1	PC-IV	PITEC 201	Advanced Operating Systems	4	-	-	25	75	100	3	ITEC 201
2	PC-V	PITEC 202	Multi-Core Architecture	4	-	-	25	75	100	3	ITEC 202
3	PC-VI	PITEC 203	Big Data Analytics	4	-	-	25	75	100	3	ITEC 203
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

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 – III											
1	PC-VII	PITEC 301	Integrated Software Engineering Methodology	4	-		25	75	100	3	ITEC 104
2	PE-I	PITEE 302	Professional Elective-I	4	-		25	75	100	3	ITEE 105
3	PE-II	PITEE 303	Professional Elective-II	4	-		25	75	100	3	ITEE 106
4	PC Lab-I	PITEP 304	Advanced Data Structures and Networking Lab	-	-	3	40	60	100	2	ITEP 107
			Total	**12**	**-**	**3**	**115**	**285**	**400**	**11**	

S.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 – IV											
1	PC-VIII	PITEC 401	Mobile and Pervasive Computing	4	-	-	25	75	100	3	ITEC 204
2	PE-III	PITEE 402	Professional Elective-III	4	-	-	25	75	100	3	ITEE 205
3	PE-IV	PITEE 403	Professional Elective-IV	4	-	-	25	75	100	3	ITEE 206
4	PC Lab-II	PITEP 404	Big Data and Hadoop Lab	-	-	3	40	60	100	2	ITEP 207
5	Semin	PITES405	Seminar		-	2	100		100	1	ITES208
			Total	**12**	**-**	**5**	**215**	**285**	**500**	**12**	

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 – V											
1	OE-I	PITEE 501	Open Elective – I	4	-	-	25	75	100	3	ITEE301
2	OE-II	PITEE 502	Open Elective – II	4	-	-	25	75	100	3	ITEE302
3	Thesis	PITET 503	Thesis Phase-I	-	4	-	40	60	100	4	ITET303
4	Ind Train	PITEI 504	Industrial Training		*	-	100		100	2	ITEI304
			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	PITET 601	Thesis Phase-II	-	8	-	40	60	100	12	ITET 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.	Optimization Techniques
2.	Information Storage and Management
3.	Protocols and Architecture for Wireless Sensor Networks
4.	Applied Advanced Routing
5.	Semantic Web
6.	Advanced Databases
7.	Optical Networks
8.	Cluster Computing
9.	Cloud computing Technologies
10.	Green Computing
11.	Quantum Computing
12.	Cryptography and Information Security
13.	Wireless Communication Techniques
14.	Internet of Things
15.	Cross – Informatics
16.	Text Mining
17.	Machine Learning Techniques
18.	Software Reliability Engineering
19.	3G and 4G Wireless Networks
20.	Biometric Image Processing
21.	Biometric Security
22.	Distributed Systems Security
23.	Wireless Security
24.	Speech Processing and Synthesis
25.	Sensing Techniques and Sensors

LIST OF OPEN ELECTIVES

S.No	OPEN ELECTIVES
1.	Web Integrated Technologies
2.	Decision Management Systems
3.	Cyber Forensics
4.	Data Science and Analytics
5.	Pattern Recognition
6.	Human Computer Interaction
7.	Soft Computing and Applications
8.	Mobile Application Development
9.	Information retrieval
10.	Middleware for Communications

ITEC101	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:

Upon Completion of the 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**	**PO9**	**PO10**
CO1	✓	✓	✓	✓						
CO2	✓	✓		✓	✓	✓			✓	
CO3	✓		✓	✓	✓				✓	✓
CO4		✓	✓			✓	✓			

ITEC102	**ADVANCED DATA STRUCTURES AND ALGORITHM**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the usage of algorithms in computing.
- To learn and use hierarchical data structures and its operations.
- To learn the usage of graphs and strings and its applications.

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method.

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion- B-Trees: Definition of Btrees – Basic operations on B-Trees – Deleting a key from a B-Tree- Binomial Heaps: Binomial Trees and Binomial Heaps – Operations on Binomial Heaps.

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All- Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd - Warshall Algorithm; Maximum Flow: Flow Networks – The Ford-Fulkerson method – Maximum Bipartite Matching; String Matching: The Native String-Matching Algorithm – The Knuth-Morris-Pratt Algorithm.

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy – Huffman Codes.

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP-Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Prentice-Hall, 2001.
2. Robert Sedgewick and Kevin Wayne, "Algorithms", Fourth Edition, Pearson Education.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
4. Donald E Knuth, "Art of Computer Programming-Volume I- Fundamental Algorithms", Third edition, Addison Wesley, 1997.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Design data structures and algorithms to solve computing problems.
2. Become familiar with the specification, usage, implementation and analysis of hierarchical data.
3. Understand the usage of graphs and strings and its applications.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓						
CO2	✓	✓		✓	✓	✓			✓	
CO3	✓	✓	✓	✓	✓			✓	✓	✓

ITEC103	**ADVANCED NETWORK TECHNOLOGY**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To provide an introduction to the principles and practices of Network Engineering.
- To understand the architecture of the network devices.
- To explore the emerging technologies in network engineering.

Communication Networks – Network Elements – Switched Networks and Shared Media Networks – Probabilistic Model and Deterministic Model – Datagrams and Virtual Circuits – Multiplexing – Switching – Error and Flow Control – Congestion Control – Layered Architecture – Network Externalities – Service Integration.

Traffic Characteristics and Descriptors – Quality of Service and Metrics – Best Effort model and Guaranteed Service Model – Limitations of IP networks – Scheduling and Dropping

Policies for BE and GS models – Traffic Shaping Algorithms – End to End Solutions – Laissez Faire Approach – Possible improvements in TCP – Significance of UDP in Inelastic Traffic.

Integrated Services Architecture – Components and Services – Differentiated Services Networks – Per Hop Behavior – Admission Control – MPLS Networks – Principles and Mechanisms – Label Stacking – RSVP – RTP/RTCP.

Network Devices – Switch – Router – Hardware Components- Software – Configuration – Routing Concepts- Static Routing – Dynamics Routing–Switching and Routing Devices – Router Structure – Configuring EGP – RIP – OSPF – IS-IS – Hub – Bridges – Routers – Link Virtualization – Multicast Architecture.

History – Data Plane Support for SDN – Software Routers – Programmable Hardware – Control Plane Support for SDN – Modern SDN Stack – Programming Languages – Applications – Data Centre Networking –Software Defined Radio –Campus Networks.

REFERENCES:

1. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education/PHI, 2009.
2. Larry L Peterson and Bruce S Davie, 'Computer Networks: A Systems Approach', Fifth Edition, Morgan Kaufman Publishers, 2012.
3. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
4. James Macfarlane ," Network Routing Basics: Understanding IP Routing in Cisco Systems", Wiley Edition I, 2006.
5. William Stallings, High Speed Networks: Performance and Quality of Service, Pearson Education, 2008.
6. Mani Subramaniam, Network Management: Principles and Practices, Pearson Education, 2010.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Gain an understanding of the principles of network engineering.
2. Knowledge of advanced network engineering concepts and techniques.
3. Explore the emerging technologies in network engineering.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1		✓	✓	✓		✓	✓		✓	✓
CO2	✓	✓	✓	✓					✓	✓
CO3	✓	✓	✓	✓	✓			✓		

ITEC104	INTEGRATED SOFTWARE ENGINEERING METHODOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To provide information about wider engineering issues that form the background to developing complex, evolving (software-intensive) systems.
- To plan a software engineering process to account for quality issues and non – functional requirements.
- To employ a selection of concepts and techniques to complete a small-scale analysis and design in mini projects.
- To impart knowledge to translate requirement specifications into a design, and then realize that design practically, all using an appropriate software engineering methodology.
- To provide basic knowledge about software project management.

Introduction – S/W Engineering Paradigm –– Life Cycle Models –Introduction to System Concepts - Managing Complex Software –– Properties – Object Oriented Systems Development – Object Basics – Systems Development Life Cycle Rumbaugh Methodology - Booch Methodology - Jacobson Methodology – Unified Process.

Systems Engineering - Analysis Concepts - Functional and Non-Functional – Software Document – Requirement Engineering Process – Feasibility Studies – Software Prototyping – Prototyping in the Software Process – Data – Functional and Behavioral Models – Structured Analysis and Data Dictionary. Unified Approach – Unified Modeling Language – Static behavior diagrams – Dynamic Behavior diagrams – Object Constraint Language.

Design Process And Concepts – Modular Design – Design Heuristic – Architectural Design – Data Design – User Interface Design – Requirements to Design – Design Axioms – Logical Architecture - Designing Objects with Responsibilities – Object Design – Designing for Visibility. Patterns – Analysis and Design patterns – GoF Patterns - Mapping designs to code –Test Driven development and refactoring – UML Tools and UML as blueprint.

Taxonomy of Software Testing – Types of S/W Test – Black Box Testing – Testing Boundary Conditions – Structural Testing – Test Coverage Criteria Based on Data Flow Mechanisms – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques.

Measures and Measurements – ZIPF‟s Law – Software Cost Estimation – Function Point Models – COCOMO Model – Delphi Method – Scheduling – Earned Value Analysis – Error Tracking – Software Configuration Management – Program Evolution Dynamics – Software Maintenance – Project Planning – Project Scheduling– Risk Management – CASE Tools.

REFERENCES:

1. Ian Sommerville, “Software engineering”, Ninth Edition, Pearson Education Asia, 2010.
2. Roger S. Pressman, “Software Engineering – A practitioner’s Approach”, Seventh Edition, Tata McGraw-Hill International Edition, 2009.
3. Ivar Jacobson, “Object Oriented Software Engineering”, Pearson Education, 1992.

4. Pankaj Jalote, "An Integrated Approach to Software Engineering", Third Edition, Narosa publications, 2011.
5. Craig Larman. "Applying UML and Patterns – An introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd edition, Pearson Education, 2005.
6. Fowler, Martin, "UML Distilled", 3rd Edition, Pearson Education, 2004.
7. Michael Blaha and James Rumbaugh, "Object-oriented modeling and design with UML", Prentice-Hall of India, 2005.
8. Grady Booch, "Object Oriented Analysis and Design", 2nd edition, Pearson Education, 2000.
9. Ali Bahrami, "Object Oriented Systems Development", Tata McGrawHill, 1999.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Learn UML models and tools.
2. Apply design patterns on various applications.
3. Understand the concepts and techniques to complete a small-scale analysis and design in mini projects.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓		✓	✓				✓
CO2		✓	✓	✓	✓			✓	✓	
CO3	✓	✓	✓			✓			✓	✓

ITEC107	**ADVANCED DATA STRUCTURES AND NETWORKING LAB**	L	T	P
		0	0	3

COURSE OBJECTIVES:

- To acquire the knowledge of using advanced tree structures.
- To learn the usage of heap structures.
- To understand the usage of graph structures and spanning trees.
- To learn the working of various string matching algorithms.

LIST OF EXERCISES

1. Implementation of a Binary Search Tree.
2. Red-Black Tree Implementation.
3. Heap Implementation.
4. Binomial Heaps.
5. Graph Traversals.
6. Spanning Tree Implementation.
7. Shortest Path Algorithms.
8. String Matching Algorithms.
9. Approximation Algorithms.

10. Study of network simulators like NS2, Glomosim, OPNET.
11. Implementation of client-server communication using TCP.
12. Implementation of UDP client server communication using bind, Sendto, Recvfrom system call.
13. Implementation of simple FTP client.
14. Implementation of Domain Name Space.
15. Simulation of BGP/OSPF routing protocol.
16. Simulation of ARP/RARP.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Design and implement basic and advanced data structures extensively.
2. Design algorithms using graph structures.
3. Design and develop efficient algorithms with minimum complexity using design techniques.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓					✓	
CO2	✓	✓	✓	✓	✓					✓
CO3	✓	✓	✓	✓				✓	✓	✓

ITEC201	**ADVANCED OPERATING SYSTEMS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the fundamentals of Operating system.
- To gain knowledge on Distributed operating system.
- To know the components and management aspects of Mobile operating systems.

Overview – Synchronization Mechanisms – Process and Threads- Process Scheduling – Deadlocks: Detection – Prevention- Recovery – Models of Resources – Memory Management.

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

Distributed File System – Design Issues – Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.

Basic Model of Real Time Systems – Characteristics- Applications of Real Time Systems – Real Time Task Scheduling – Handling Resource Sharing – Mobile Operating Systems – Micro Kernel Design – Client Server Resource Access – Processes and Threads – Memory Management – Filesystem.

Linux System: Design Principles – Kernel Modules – Process Management Scheduling – Memory Management – Input-Output Management – File System – Interprocess Communication. Windows XP: Design Principles – System Components – Process and Thread Management – Memory Management – File System. Iphone iOS4: Architecture and SDK Framework – Media Layer – Services Layer – Core OS Layer – File System.

REFERENCES:

1. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
3. Andrew S.Tanenbaum, "Modern Operating System", Third Edition, Prentice Hall Inc., 2008.
4. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to

1. Possess a complete overview of process management & memory management of Operating system.
2. To demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
3. Familiarize with the various Operating Systems.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓		✓		✓		✓
CO2	✓	✓	✓	✓		✓		✓		✓
CO3		✓			✓		✓	✓	✓	✓

ITEC202	**MULTI–CORE 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 the 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.

COURSE OUTCOMES:

Upon completion of this course, the student should 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. To understand the different multiprocessor issues.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓		✓		✓				
CO2	✓	✓	✓	✓	✓	✓		✓		✓
CO3	✓	✓	✓					✓	✓	✓

ITEC203	BIG DATA ANALYTICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn and implement the computational approaches to Modeling, Feature Extraction.
- To grasp the various search algorithms applicable to Big Data.
- To comprehend the necessity and application of Map Reduce.
- To evaluate and infer streaming data.
- To acquire knowledge of how to handle large data sets.

Introduction of Data Science – Basic Data Analytics using R – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.

Advanced analytical theory and methods - Overview of Clustering – K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R – Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.

Big data from different perspectives - Big data from business Perspective: Introduction of big data-Characteristics of big data-Data in the warehouse and data in Hadoop- Importance of Big data- Big data Use cases: Patterns for Big data deployment. Big data from Technology Perspective: History of Hadoop-Components of Hadoop-Application Development in Hadoop-Getting your data in Hadoop-other Hadoop Component.

Hadoop distributed file system architecture - HDFS Architecture – HDFS Concepts – Blocks – NameNode – Secondary NameNode – DataNode – HDFS Federation – Basic File System Operations – Data Flow – Anatomy of File Read – Anatomy of File Write.

Processing your data with mapreduce - Getting to know MapReduce – MapReduce Execution Pipeline – Runtime Coordination and Task Management – MapReduce Application – Hadoop Word Count Implementation.

REFERENCES:

1. David Dietrich, Barry Heller and Beibei Yang, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley, ISBN 13:9788126556533, 2015.
2. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data", The McGraw-Hill Companies, ISBN : 978-0-07-179054-3, 2012.
3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly, ISBN: 9789352130672, 2015.
4. Biris Lublinsky, Kevin T. Smith and Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN 13:9788126551071, 2015.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Identify the need for big data analytics for a domain.
2. Use Hadoop, Map Reduce Framework.
3. Apply big data analytics for a given problem.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓		✓			✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓			✓	✓
CO3		✓	✓	✓	✓	✓				

ITEC204	**MOBILE AND PERVASIVE COMPUTING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the basics of Mobile Computing and Personal Computing.
- To learn the role of cellular networks in Mobile and Pervasive Computing.
- To expose to the concept of sensor and mesh networks.
- To expose to the context aware and wearable computing.
- To learn to develop applications in mobile and pervasive computing environment.

Introduction – Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices.

3G AND 4G Cellular Networks – Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP.

Sensor And Mesh Networks – Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination – Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach – Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks.

Context Aware Computing & Wearable Computing – Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware Health BAN- Medical and Technological Requirements-Wearable Sensors-Intra-BAN communications.

Application Development – Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone.

REFERENCES:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", 2nd ed, Tata McGraw Hill, 2010.
2. Reto Meier, "Professional Android 2 Application Development", Wrox Wiley, 2010.
3. Pei Zheng and Lionel M Li, "Smart Phone & Next Generation Mobile Computing", Morgan Kaufmann Publishers, 2006.
4. Frank Adelstein, "Fundamentals of Mobile and Pervasive Computing", TMH, 2005.
5. Jochen Burthardt et al, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Pearson Education, 2003.
6. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufmann Publishers, 2004.
7. Uwe Hansmaan et al, "Principles of Mobile Computing", Springer, 2003.
8. Reto Meier, "Professional Android 2 Application Development", Wrox Wiley, 2010.
9. Mohammad s. Obaidat et al, "Pervasive Computing and Networking", John Wiley & Sons, 2011.
10. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Wiley, 2009.
11. Frank Adelstein Sandeep K. S. Gupta Golden G. Richard III Loren Schwiebert "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill, 2005.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Design a basic architecture for a pervasive computing environment.
2. Design and allocate the resources on the 3G-4G wireless networks.
3. Analyze the role of sensors in Wireless networks.
4. Work out the routing in mesh network.
5. Deploy the location and context information for application development.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1		✓	✓	✓	✓	✓	✓			
CO2		✓	✓	✓	✓	✓				✓
CO3	✓			✓						
CO4	✓	✓	✓	✓	✓	✓				
CO5	✓	✓	✓		✓	✓	✓			✓

ITEC207	BIG DATA AND HADOOP LAB	L	T	P
		0	0	3

COURSE OBJECTIVES:

- To understand setting up of Hadoop Cluster.
- To solve problems using Map Reduce Technique.
- To solve Big Data problems.

LIST OF EXERCISES

Cycle I – Data Mining Using Weka

1. Identifying Rules and important Attributes.
2. Executing Classification Algorithms.
3. Deletion of Attribute, Cross Validation and Visualizing.
4. Perform Test Case Scenario.
5. Use Pruning and Reduced Error Pruning.
6. Compare different Classification Algorithms.
7. Clustering Algorithm.
8. Association Rule Mining.

Cycle II – Python Programming

9. Perform Fibonacci Sequence.
10. Calculate Area for Square, Rectangle and Circle.
11. Run a Test of Knowledge.
12. Finding most frequent words in a text read from a file.

Cycle III – Hadoop

13. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
14. Map Reduce application for word counting on Hadoop cluster.
15. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
16. K-means clustering using map reduce.
17. Page Rank Computation.
18. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
19. Application of Recommendation Systems using Hadoop/mahout libraries.

COURSE OUTCOMES:

Upon of completion of this course, students will be able to

1. Set up multi-node Hadoop Clusters.

2. Apply Map Reduce algorithms for various algorithms.
3. Design new algorithms that uses Map Reduce to apply on Unstructured and structured data.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓			✓	
CO2	✓	✓	✓	✓	✓				✓	✓
CO3		✓	✓	✓	✓			✓	✓	

ITES 208	SEMINAR	L	T	P
		4	0	2

COURSE OBJECTIVES:

- To work on a technical topic related to Information Technology 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 Information Technology 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. Face the audience and to interact with them confidently.
2. Tackle any problem during group discussion in the corporate interviews.
3. 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**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓			✓	
CO2	✓	✓	✓	✓	✓				✓	✓
CO3		✓	✓	✓	✓		✓	✓	✓	

ITET 303	THESIS PHASE - I	L	T	P
		0	0	4

COURSE OBJECTIVES:

- To train the students in the current thrust area in Information Technology 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 Information Technology 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:

Upon Completion of the 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**	**PO9**	**PO10**
CO1	✓		✓	✓		✓		✓		✓
CO2		✓		✓		✓	✓		✓	✓
CO3	✓	✓	✓		✓		✓		✓	✓

ITEI 304	**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 Information Technology and to have a practical knowledge in carrying out the Information Technology related problems.
- To train and develop skills in solving problems during execution of the problems related to Information Technology.

The students will individually undertake a training program in reputed concerns in the field of Information Technology 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:

Upon Completion of the 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 Information Technology standard in a specific situation.
2. Analyze a given Information Technology 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**	**PO9**	**PO10**
CO1	✓	✓	✓	✓			✓		✓	✓
CO2		✓			✓			✓	✓	✓
CO3	✓	✓	✓		✓		✓		✓	

ITET 401	**THESIS PHASE - II**	L	T	P
		0	0	8

COURSE OBJECTIVES:

- To train the students in the current thrust area in Information Technology 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 Information Technology. 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:

Upon Completion of the 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**	**PO9**	**PO10**
CO1	✓		✓	✓		✓		✓		✓
CO2		✓		✓		✓	✓		✓	✓
CO3	✓	✓	✓		✓		✓		✓	✓

PROFESSIONAL ELECTIVES

ITEE X0X	OPTIMIZATION TECHNIQUES	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand different forms of intermediate languages and analyzing programs.
- To understand optimizations techniques for single program blocks.
- To apply optimizations on procedures and low-level code.
- To explore and enhance inter procedural optimizations.
- To enhance resource utilization.

Graphical method, Simplex method, Revised simplex method, Duality in linear programming, Sensitivity analysis, Transportation and assignment problems.

Unconstrained optimization techniques: Direct search methods - Descent methods, Constrained optimization: Random search methods -Complex method.

Network representation, Critical path computation, Crashing, PERT calculations, Resource analysis in network scheduling.

Decision making under certainty: Analytic hierarchy process, Decision making under risk, Decision under uncertainty, Game theory: Basic terminologies - Optimal solution of two-person zero-sum games - Solution of mixed strategy games.

Elements of a queuing model, Role of exponential distribution, Pure birth and death models, Generalized Poisson queuing model, Specialized Poisson queues, Pollaczek – Khintchine formula, Queuing decision models.

REFERENCES:

1. Hamdy A Taha, “Operations Research: An Introduction”, Pearson Education, New Delhi, 2012.
2. Frederick S Hillier and Gerald J Lieberman, “Operations Research: Concepts and Cases”, Tata McGraw Hill, New Delhi, 2012.
3. Singaresu S Rao, “Engineering Optimization: Theory and Practice”, New Age International, New Delhi, 2011.
4. Gupta C B, “Optimization Techniques in Operations Research”, I K International, New Delhi, 2008.
5. Sharma J K, “Operations Research: Theory and Applications”, Macmillan Company, New Delhi, 2007.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to:

1. Design and analyze various optimization techniques.
2. Manage procedures with optimal overheads.
3. Ensure better utilization of resources.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓					✓	
CO2	✓	✓	✓	✓	✓	✓				
CO3	✓	✓						✓	✓	✓

ITEE X0X	**INFORMATION STORAGE AND MANAGEMENT**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To identify the components of managing the data center and understand logical and Physical components of a storage infrastructure.
- To evaluate storage architectures including storage subsystems SAN, NAS, IPSAN, CAS.
- To understand the business continuity, backup and recovery methods.

Introduction to Information Storage Management - Data Center Environment– Database Management System (DBMS) - Host - Connectivity –Storage-Disk Drive Components-Intelligent Storage System -Components of an Intelligent Storage System- Storage Provisioning- Types of Intelligent Storage Systems.

Fibre Channel: Overview - SAN and Its Evolution -Components of FC SAN -FC Connectivity-FC Architecture- IPSAN-FCOE-FCIP-Network-Attached Storage- General-Purpose Servers versus NAS Devices - Benefits of NAS- File Systems and Network File Sharing-Components of NAS - NAS I/O Operation -NAS Implementations -NAS File-Sharing Protocols-Object-Based Storage Devices Content - Addressed Storage -CAS Use Cases.

Business Continuity -Information Availability -BC Terminology-BC Planning Life Cycle - Failure Analysis -Business Impact Analysis-Backup and Archive - Backup Purpose Backup Considerations -Backup Granularity - Recovery Considerations -Backup Methods -Backup Architecture - Backup and Restore Operations.

Cloud Enabling Technologies -Characteristics of Cloud Computing -Benefits of Cloud Computing -Cloud Service Models-Cloud Deployment models - Cloud Computing Infrastructure-Cloud Challenges.

Information Security Framework -Storage Security Domains-Security Implementations in Storage Networking - Monitoring the Storage Infrastructure -Storage Infrastructure Management Activities -Storage Infrastructure Management Challenges.

REFERENCES:

1. EMC Corporation, Information Storage and Management", Wiley India, Edition, 2011.
2. Robert Spalding, Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, Edition, 2001.

4. Meeta Gupta, “Storage Area Network Fundamentals”, Pearson Education Limited, 2002.

COURSE OUTCOMES:

Upon completion of this course the students may be able to

1. Provide a variety of solutions for storing, managing, accessing, protecting, securing, sharing and optimizing information.
2. Evaluate storage architectures, including storage subsystems SAN, NAS, IPSAN, CAS.
3. Understand the business continuity, backup and recovery methods.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓					✓	✓
CO2	✓	✓	✓	✓	✓	✓				
CO3	✓	✓						✓	✓	✓

ITEE X0X	**PROTOCOLS AND ARCHITECTURE FOR WIRELESS SENSOR NETWORKS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn about the issues in the design of ad hoc and wireless sensor networks.
- To understand the working of protocols in different layers of ad hoc and sensor networks.
- To expose the students to different aspects in ad hoc and sensor networks.
- To understand various standards and applications in ad hoc and sensor networks.

Introduction and Overview of Wireless Sensor Networks, Background of Sensor Network Technology, Application of Sensor Networks, Challenges for Wireless Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

Architectures, Single-node Architecture, Hardware Components & Design Constraints, Operating Systems and Execution Environments, Introduction to TinyOS and nesC, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs, Service Interfaces of WSNs, Gateway Concepts.

Deployment and Configuration, Localization and Positioning, Coverage and Connectivity, Single-hop and Multi-hop Localization, Self-Configuring Localization Systems, Sensor Management Network Protocols: Issues in Designing MAC Protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC Protocol, IEEE 802.15.4 Standard and Zig Bee, Dissemination Protocol for Large Sensor Network.

Routing Protocols and Data Manipulation, Issues in Designing Routing Protocols, Classification of Routing Protocols, Energy-Efficient Routing, Unicast, Broadcast and

Multicast, Geographic Routing. Data Centric and Content based Routing, Storage and Retrieval in Network, Compression Technologies for WSN, Data Aggregation Technique.

Sensor Network Platforms and Tools, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level Software Platforms, Node-level Simulators, State-centric Programming.

REFERENCES:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
5. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer – Verlag Berlin Heidelberg, 2007.
6. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

COURSE OUTCOMES:

Upon completion of this course students should be able to

1. Identify different issues in wireless ad hoc and sensor networks.
2. Analyze the protocols developed for ad hoc and sensor networks.
3. Identify and discuss the standards and applications of ad hoc and sensor networks.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓						✓
CO2	✓	✓	✓		✓	✓				
CO3		✓						✓		✓

ITEE X0X	**APPLIED ADVANCED ROUTING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand and work with network devices and technologies.
- To understand and deploy various interior and exterior routing protocols.
- To learn and work with next generation IP (IPv6).

Introduction to computer networks, Evolution of Computer Networks (History) Classification of Computer Networks (LAN, WAN, MAN, PAN, INTERNET) OSI Layered Architecture – TCP/IP Model-Networking devices.

IPv4 addressing architecture, IP Protocol suite – IPv4 Public and Private Address- Sub-netting-VLSM-CIDR-Zinin‘s Routing principles - Classification of routing protocols.

Introduction to EIGRP –EIGRP technologies–Reliable transport protocols–DUALEIGRP packet types–EIGRP tables–EIGRP terminology- Introduction to OSPF-Basic OSPF configuration–OSPF topologies–OSPF areas–LSA sequence numbering Configuring OSPF for multiple areas – OSPF over non-broadcast multi access topology – virtual links – Stub and totally stubby area.

Exterior Gateway Routing Protocols, Autonomous systems – IANA – RIR‘s - BGP operational overview – Public IP address space – Single, double and multi- homed ISP‘s-BGP databases – BGP message types – EBGP- IBGP –BGP commands –BGP states –BGP Attributes and path control- Route optimization and Route distribution.

Intoduction to IPv6, IPv6 advanced features –V4 and V6 header compression – V6 address types – Stateless auto configuration – IPv6 routing protocols – IPv4-V6 tunneling and transition techniques- Advanced Interior Gateway Protocol Redistribution.

REFERENCES:

1. Todd Lammle, CCNA Cisco Certified Network Associate Study Guide, Sybex; 7th Edition, ISBN: 978-0-470-90107-6, 2011.
2. Wendell Odom, CCNP Route 642-902, Official Certification Guide, CCIE, Pearson Publication, Published:, ISBN-10: 1-58720-253-0, ISBN-13: 978-158720-253-7, 2010.
3. Forouzan, Behrouz A., and Sophia Chung Fegan. TCP/IP protocol suite. McGraw-Hill Higher Education, 2002.
4. Douglas E.Comer, “Internet Working with TCP/IP Principles, Protocols, and Architecture”, 5th Edition, Publication ISBN-10: 0130183806 | ISBN13: 978-0130183804 2000.
5. Balchunas, Aaron. "Cisco CCNP Routing Study Guide." Router Alley, 2013.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Develop competence towards design and deployment of Routing on high end computer networks.
2. Work with network devices and technologies.
3. Deploy various interior and exterior routing protocols.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓		✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓					
CO3		✓						✓	✓	✓

ITEE X0X	SEMANTIC WEB	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the importance of semantic web.
- To understand various semantic knowledge representation strategies.
- To learn the concepts of ontology.
- To learn the ontology related tools.

The Future of the Internet: Introduction - The Syntactic Web – The Semantic Web - How the Semantic Web Will Work. Ontology in Computer Science - Defining the Term Ontology - Differences among Taxonomies – The sauri – and Ontologies, Classifying Ontologies - Web Ontologies, Web Ontology Description Languages - Ontology - Categories - and Intelligence.

Knowledge Representation in Description Logic – Introduction - An Informal Example - The Family of Attributive Languages - Inference Problems. RDF and RDF Schema – Introduction - XML Essentials – RDF – RDF Schema - A Summary of the RDF/RDF Schema Vocabulary. OWL – Introduction - Requirements for Web Ontology Description Languages – Header Information – Versioning – and Annotation Properties – Properties – Classes – Individuals – Data types - A Summary of the OWL Vocabulary.

Rule Languages – Introduction - Usage Scenarios for Rule Languages – Datalog – RuleML – SWRL - TRIPLE. Semantic Web Services – Introduction - Web Service Essentials – OWL - S Service Ontology - An OWL - S Example.

Methods for Ontology Development – Introduction - Uschold and King Ontology Development Method - Toronto Virtual Enterprise Method – Methontology - KACTUS Project Ontology Development Method – Lexicon – Based Ontology Development Method - Simplified Methods Ontology Sources – Introduction – Metadata – Upper Ontologies Other Ontologic of Interest – Ontology Libraries.

Semantic Web Software Tools – Introduction - Metadata and Ontology Editors – Reasoners - Other tools. Software Agents – Introduction - Agent Forms - Agent Architecture - Agents in the Semantic web Context. Semantic Desktop – Introduction - Semantic Desktop Metadata - Semantic Desktop Ontologies - Semantic Desktop Architecture - Semantic Desktop Related Applications. Ontology Application in Art – Introduction – Ontologies for the Description of Works of Art - Metadata Schemas for The Description of Works of Art - Semantic Annotation of Art Images.

REFERENCES:

1. Karin K. Breitman, Marco Antonio Casanova and Walter Truszowski, “Semantic Web Concepts: Technologies and Applications”, Springer Science & Business Media, 2007.
2. Heiner Stuckenschmidt, Frank van Harmelen,” Information Sharing on the Semanting Web”, Springer Science & Business Media, 2005.
3. Grigoris Antoniou, Frank Van, “Semantic Web Primer”, MIT press, 2004.
4. Rudi Studer, Stephan Grimm, Andrees Abeker, “Semantic Web Services: Concepts, Technologies and Applications”, Springer, 2007.

5. John Davis, Dieter Fensal, Frank Van Harmelen,J. Wiley , "Towards the Semantic Web: Ontology Driven Knowledge Management", John Wiley & Sons, 2003.

COURSE OUTCOMES:

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

1. Compare conventional web with semantic web.
2. Analyze and design semantic knowledge representation modes.
3. Construct ontology using different tools.
4. Use semantic web services with web applications.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓			✓	
CO2		✓	✓	✓	✓					
CO3	✓	✓		✓	✓			✓	✓	✓

ITEE X0X	**ADVANCED DATABASES**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of advanced data models.

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications Design –Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Implementation of Rules and Recursion- Recursive Queries in SQL - Spatial Databases - Spatial Data Types- Spatial Relationships- Spatial Data Structures – Spatial Access Methods- Spatial DB Implementation.

Mobile Databases: Location and Handoff Management – Effect of Mobility on Data Management – Location Dependent Data Distribution – Mobile Transaction Models – Concurrency Control – Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages-Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases-Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

REFERENCES:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2008.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Fourth Edition, Pearson Education, 2008.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
5. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers, 2006.
6. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, 2006.
7. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Develop in-depth understanding of relational databases and skills to optimize database performance in practice.
2. Understand and critique on each type of databases.
3. Design faster algorithms in solving practical database problems.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓			✓	✓		✓	✓
CO2	✓	✓	✓	✓					✓	
CO3	✓	✓	✓	✓	✓	✓				✓

ITEE X0X	OPTICAL NETWORKS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue.
- To expose the student to the advances in packet switching in the optical domain, the associated challenges and the possible solution approaches.

Introduction – Light wave generation systems, system components, optical fibers, SI, GI, fibers, modes, Dispersion in fibers, limitations due to dispersion, Fiber loss, nonlinear effects. Dispersion shifted and Dispersion flattened fibers. Optical transmitters, receivers and amplifiers. First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, switches, and wavelength converters.

Optical Network Architectures – Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks-Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture. Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

Broadcast And Select Networks – Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access control protocols, Test beds. WAVELENGTH-ROUTING NETWORKS: The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment, Virtual Topology design, Wavelength Routing Test beds, Architectural variations.

Packet Switching and Access Networks – Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch based networks; Access Networks- Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

High Capacity Networks, Network Design and Management – SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test bed. Transmission system Engineering-system model, Power penalty-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network manage functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.

REFERENCES:

1. Rajiv Ramaswami and Kumar Sivarajan, “Optical Networks: A practical perspective”, Morgan Kaufmann, 2nd edition, 2001.
2. Vivek Alwayn, “Optical Network Design and Implementation”, Pearson Education, 2004.
3. Keiser G., “Optical fiber communication systems”, McGraw - Hill, 2000.

4. Hussein T. Mouftab and Pin-Han Ho, "Optical Networks: Architecture and Survivability", Kluwer Academic Publishers, 2002.
5. Biswanath Mukherjee, "Optical Communication Networks", McGraw Hill, 1997.
6. Ramaswami, Rajiv, Kumar Sivarajan, and Galen Sasaki, "Optical networks: a practical perspective", Morgan Kaufmann, 2009.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Learn the importance of the backbone infrastructure for our present and future communication needs.
2. Familiarize with the architectures and the protocol stack in use.
3. Understand the differences in the design of routing, switching and the resource allocation methods.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓				✓	✓	✓	✓	✓
CO2	✓	✓	✓						✓	
CO3	✓	✓	✓	✓	✓					

ITEE X0X	**CLUSTER COMPUTING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To be able to understand the Cluster installation and configuration.
- To understand the Parallel programming models & paradigms.
- To familiarize with Job management system and cluster scheduling process.

Overview of cluster computing: Elements of cluster, requirements-classes of cluster-Hardware system structure- Node software- Node hardware: Mother board, Memory, Basic Input Output Stream-Peripheral Component Interconnect (PCI) bus, Node assembly.

Network Hardware: Interconnecting Technologies, Pitfalls in cluster networks-Network software: sockets, Distributed File System, Remote command execution-Setting up clusters: Cluster configuration, Installation of a node, Basic system administration-Security- NPACI Rocks (Rocks cluster Distribution) - OSCAR Toolkits-Load balancing.

Parallel programming with Message Passing Interface (MPI): MPI compilation and running process, Implementation of MPI for clusters-Dynamic process management-Fault tolerance-RMA- Performance measurement - Parallel Virtual Machine (PVM): Overview, Setup, console details Extended PVM.

Goal of workload management software- management activities-Distributed job scheduler-condor: features, architecture- Installation-Configuration –Administration tools.

Scheduling Parallel jobs on cluster-High performance cluster scheduler: Maui: overview, Installation-Configuration -Overview of Portable Batch System: Architecture, Features and PVFS: Parallel virtual File System-Mapping and scheduling on Heterogeneous system.

REFERENCES:

1. Thomas Sterling, "Beowulf Cluster Computing with Linux", MIT Press, Second Edition, 2003.
2. Rajkumar Buyya , "High Performance Cluster Computing: Architectures and Systems", Vol. 1, Prentice Hall PTR, 2007.
3. Rajkumar Buyya, "High Performance Cluster Computing: Programming and Applications", Vol 2, Prentice Hall PTR, NJ, USA, 1999.
4. Plaza, Antonio J., and Chein-I. Chang, eds. High performance computing in remote sensing. CRC Press, 2007.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Learn the Cluster installation and configuration methods and tools.
2. Understand the Parallel programming models & paradigms.
3. Familiarize the job management system and cluster scheduling process.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO2		✓	✓						✓	
CO3	✓	✓	✓			✓	✓			

ITEE X0X	**CLOUD COMPUTING TECHNOLOGIES**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn about different deployment models of cloud and different services offered by cloud.
- To understand the technique of virtualization through theoretical concepts and practical training.
- To become knowledgeable in the rudimentary aspects of cloud application development.

Cloud computing components- Infrastructure-services- storage applications-database services – Deployment models of Cloud- Services offered by Cloud- Benefits and Limitations of Cloud Computing – Issues in Cloud security- Cloud security services and design principles.

Virtualization – Enabling technology for cloud computing- Types of Virtualization- Server Virtualization- Desktop Virtualization – Memory Virtualization – Application and Storage Virtualization- Tools and Products available for Virtualization.

Getting started with SaaS- Understanding the multitenant nature of SaaS solutions- Understanding OpenSaaS Solutions- Understanding Service Oriented Architecture- PaaS- Benefits and Limitations of PaaS.

Understanding IaaS- Improving performance through Load balancing- Server Types within IaaS solutions- Utilizing cloud based NAS devices – Understanding Cloud based data storage- Cloud based backup devices- Cloud based database solutions- Cloud based block storage.

Client Server Distributed Architecture for cloud – Traditional apps vs. Cloud apps – Client-side programming model: Web clients. Mobile clients- Server-Side Programming Technologies: AJAX, JSON, Web Services (RPC, REST) – MVC Design Patterns for Cloud Application Development.

REFERENCES:

1. Kumar Saurabh, "Cloud Computing: Insights into New – Era Infrastructure", Wiley India, 2011.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill Edition, Fourth Reprint, 2010.
3. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more", Jones & Bartlett Learning Company LLC, 2013.
4. Ronald L.Krutz, Russell vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing Inc., 2010.
5. Barrie Sosinsky, "Cloud computing bible", Vol. 762, John Wiley & Sons, 2010.
6. Gautam Shroff, "Enterprise cloud computing: technology, architecture, applications", Cambridge university press, 2010.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Improve the performance and availability over that of cluster computers.
2. Perform virtualization through theoretical concepts and practical training.
3. Gain knowledge in the rudimentary aspects of cloud application development.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓			✓	✓			✓
CO2	✓	✓	✓	✓	✓					
CO3	✓	✓						✓	✓	✓

ITEE X0X	GREEN COMPUTING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To acquire knowledge to adopt green computing practices.
- To understand how to minimize equipment disposal requirements.

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

REFERENCES:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011.
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.
3. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
4. John Lamb, "The Greening of IT", Pearson Education, 2009.
5. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
6. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
7. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Minimize negative impacts on the environment.
2. Develop skill in energy saving practices in their use of hardware.
3. Examine technology tools that can reduce paper waste and carbon footprint by user.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓				✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓			✓	✓
CO3	✓	✓	✓	✓				✓		

ITEE X0X	**QUANTUM COMPUTING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To study, why to be interested in quantum computing.
- To emphasize the prehistory of quantum computing.
- To specify the properties of quantum computing in comparison with randomized computing.
- To learn the basic experiments and principles of quantum physics.
- To understand the basics of Hilbert space theory and the elements of classical reversible computing.

Fundamental Concepts - Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.

Quantum Computation – Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.

Quantum Computers - Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

Quantum Informations – Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.

Quantum Error Correction – Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

REFERENCES:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.

2. Eleanor G. Rieffel , Wolfgang H. Polak , “Quantum Computing - A Gentle Introduction” (Scientific and Engineering Computation) Paperback – Import, 3 Oct 2014.
3. Scott Aaronson, “Quantum Computing since Democritus”, Cambridge University Press, 2013.
4. N. David Mermin Yanofsky's and Mannucci, “Computer Science: An Introduction Quantum Computing for Computer Scientists”.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Understand and explain the basic notions of Quantum Computing - including Quantum Bits and registers, Quantum Evolution, Quantum Circuits, Quantum Teleportation and the basic Quantum Algorithms known at the present time.
2. Identify the essential difference between the classical paradigm and the quantum paradigm of computation and appreciate why quantum computers can solve currently intractable problems.
3. Work with Quantum Simulator like Revkit 1.3, JQuantum etc to design and verify different quantum circuits.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓				✓		✓	
CO2	✓	✓	✓	✓			✓		✓	✓
CO3	✓	✓	✓	✓	✓			✓	✓	

ITEE X0X	**CRYPTOGRAPHY AND INFORMATION SECURITY**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the mathematics behind Cryptography.
- To understand the standard algorithms used to provide confidentiality, integrity and authenticity.
- To get the knowledge of various security practices applied in the field of information technology.

Overview - Classical Crypto Systems – Substitution Ciphers –Transposition Ciphers- Stream and Block Ciphers – Introduction to Number Theory – Congruences – Chinese Remainder Theorem Modular Arithmetic-Modular Exponentiation – Fermats and Eulers Theorem - Finite Fields –GF(2n) Fields.

Symmetric Encryption Techniques – DES – AES- Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service - differential cryptanalysis - linear cryptanalysis - side channel attack - lattice reduction attack - Merkle-Hellman knapsack attack - Hellman's time-memory tradeoff (TMTO) attack.

Message Authentication and Hash Functions – Description of MD Hash Family – Secure Hash Algorithms – SHA 512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Process, Services, Attacks on Digital Signature- Digital Signature Schemes.

Information Security-Statistical database security -Access Control Models - Discretionary Access Control (DAC)-Mandatory Access Control (MAC)- Role-Based Access Control (RBAC); Network and Internet Security-E-mail security-User Safety-Program Security -- Viruses, Worms-Firewalls- Intrusion Detection, Fault tolerance and recovery-Information Warfare-Security Administration.

Multilevel Security- Multilevel Security Architectures- Oracle Virtual Database System-Identification/Authentication-Database Intrusion Control- Survivable Database Systems-Distributed databases- Secure transaction processing - Security in Data warehousing- Data Mining and Security- Cloud Security- Web Databases-Semi-structured Databases XML Security-Case studies- System Security-Windows security- UNIX security and Security-Enhanced Linux (SELinux)-Web security- Cross Site Scripting, Cross Site Request Forgery, SQL Injection.

REFERENCES:

1. Douglas R. Stinson. Cryptography Theory and Practice (2nd ed). CRC Press, 2002.
2. Alfred J. Menezes, Paul C. van Oorshot, Scott A. Vanstone. Handbook of Applied Cryptography, CRC Press, 1997.
3. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education, Sixth Edition, 2013.
4. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory", Second Edition, Pearson Education, 2007.
5. Mark Stamp, "Information Security: Principles and Practice", Wiley Inter Science, 2011.
6. OWASP top ten security vulnerabilities: http://xml.coverpages.org/OWASP-TopTen.pdf
7. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2007.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to

1. Apply the basic security algorithms required by any computing system.
2. Predict the vulnerabilities across any computing system.
3. Design a security solution for any computing system.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓	✓			
CO2	✓	✓	✓	✓						
CO3		✓	✓	✓	✓				✓	✓

ITEE X0X	WIRELESS COMMUNICATION TECHNIQUES	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the issues involved in mobile communication system design and analysis.
- To understand the concept of frequency reuse.
- To understand the characteristics of wireless channels.

Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel –– Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity –Capacity comparisons – Capacity of Frequency Selective Fading channels.

Fading– Outage Probability– Average Probability of Error –– Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference.

Realization of Independent Fading Paths – Receiver Diversity – Selection Combing – Threshold Combing – Maximal-Ratio Combing – Equal - Gain Combing – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems.

Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Subchannels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset – Case study IEEE 802.11a.

Frequency Reuse – Channel Assignment Strategies – Hand off Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting-Sectoring-Repeaters for Range Extension-Microcell Zone Concept.

REFERENCES:

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Wiley Series in Telecommunications, Cambridge University Press, 2005.
2. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2009.
3. Arogyaswami Paulraj, Rokit Nabar, Dhananjay Gore, “Introduction to Space-Time Wireless Communication”, 1st Edition, Cambridge University Press, 2008.
4. W.C.Y.Lee, “Mobile Cellular Telecommunications - Analog and Digital Systems”, 2nd Edition, Tata McGraw Hill, 2006.
5. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Acquire knowledge in different modulation schemes and its error probability in wireless system.
2. Learn the fundamental limits on the capacity of wireless channels.
3. Understand the diversity concepts.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓	✓			
CO2	✓	✓	✓	✓						
CO3	✓	✓	✓	✓	✓			✓	✓	

ITEE X0X	**INTERNET OF THINGS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the basics of Internet of Things.
- To get an idea of some of the application areas where Internet of Things can be applied.
- To understand the middleware for Internet of Things.
- To understand the concepts of Web of Things.
- To understand the IOT protocols.

Introduction to ad hoc networks- Differences between cellular and ad hoc wireless networks-Challenges and issues in ad hoc networks-Introduction to WSN-Single node architecture-Network architecture- Localization and positioning-Operating systems for WSN. The DNA of IoT - DCM: Device, Connect, and Manage, Device: Things that Talk, Connect: Via Pervasive Networks, Wired Networks, Wireless Networks Satellite IoT Manage: To Create New Business Value.

Middleware For IoT - Overview of Middleware, Communication Middleware for IoT - MTC/M2M Middleware, SCADA Middleware, RFID Middleware, WSN Middleware. Protocol Standards for IoT - IoT Protocol Standardization Efforts - M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards: A Challenging Task, Unified Identification of Objects.

Web of Things versus Internet of Things - Two Pillars of the Web - Architecture standardization for WoT - Platform Middleware for WoT - Standards for M2M, Frameworks for WSN, Standards for SCADA, Extensions on RFID Standards - Unified Multitier WoT Architecture, SOA/EAI versus SODA/MAI, OSGi: The Universal Middleware, WoT Framework Based on Data Standards - WoT Portals and Business Intelligence, Challenges of IoT Information Security.

Integrated Billing Solutions in the Internet of Things - Cost of RFID and the Internet of Things, Benefits of RFID and the Internet of Things, Cost Benefit Sharing, A Technical Framework for Integrating Billing Capabilities into the EPC global Network - Business

Models for the Internet of Things - Business Models and Business Model Innovation - Value Creation in the Internet of Things - Exemplary Business Model Scenarios for the Internet of Things - Product as a Service (PaaS), Information Service Provider, End – User Involvement, Right - time Business Analysis and Decision making.

Ubiquitous IoT Applications - A Panoramic View of IoT Applications - Important Vertical Applications – Telematics and Intelligent Transport Systems, Smart Grid and Electric Vehicles, Smarter Planet and Smart Buildings - Using Internet of Things Concepts to Provide High Interoperability for Logistics Systems - Semantic Web - Ontology - Ontology and the Organizational Perspective, Ontology and the IT - System Perspective, Ontology and the Data Perspective, Ontologies in Multi-agent Systems, The Role of a Top - level Ontology.

REFERENCES:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles - (Eds.) – Springer – 2011.
3. Networks, Crowds, and Markets: Reasoning About a Highly-Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010.
4. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley – 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Identify and design the new models for market strategic interaction.
2. Design business intelligence and information security for WoB.
3. Analyze various protocols for IoT.
4. Design a middleware for IoT.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓			✓	✓		
CO2		✓	✓	✓	✓				✓	
CO3	✓	✓	✓	✓				✓	✓	
CO4		✓	✓	✓	✓	✓				

ITEE X0X	**CROSS – INFORMATICS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To gain knowledge about medical informatics and healthcare informatics.
- To understand the case study of computerized patient record.

- To study and use different tools for clinical information system.
- To apply the knowledge of Bio informatics for systems.

Introduction - Structure of Medical Informatics – Internet and Medicine - Security Issues Computer based Medical Information Retrieval, Hospital Management and Information System - Functional Capabilities of a Computerized HIS - E-Health Services - Health Informatics – Medical Informatics – Bioinformatics.

Strategic Planning - Selecting a Health Care Information System - Systems Integration and Maintenance - Systems Integration - Regulatory and Accreditation Issues - Contingency Planning and Disaster Recovery.

Introduction - History taking by Computer, Dialogue with the Computer - Components and Functionality of CPR - Development Tools – Intranet - CPR in Radiology - Application Server Provider - Clinical Information System - Computerized Prescriptions for Patients.

Automated Clinical Laboratories - Automated Methods in Hematology - Cytology and Histology - Intelligent Laboratory Information System - Computerized ECG, EEG And EMG - Computer Assisted Medical Imaging - Nuclear Medicine - Ultrasound Imaging Ultrasonography - Computed X - Ray Tomography - Radiation Therapy and Planning, Nuclear Magnetic Resonance.

Pair wise Sequence Alignment – Local Versus Global Alignment – Multiple Sequence Alignment – Computational Methods – Dot Matrix Analysis – Substitution Matrices – Dynamic Programming – Word Methods – Bayesian Methods – Multiple Sequence Alignment – Dynamic Programming – Progressive Strategies – Iterative Strategies – Tools – Nucleotide Pattern Matching – Polypeptide Pattern Matching – Utilities – Sequence Databases.

REFERENCES:

1. R.D.Lele, “Computers in Medicine Progress in Medical Informatics”, Tata Mcgraw Hill Publishing Computers, 2005.
2. Mohan Bansal, “Medical informatics”, Tata McGraw Hill Publishing, 2003.
3. Burke, Lillian; Well, Barbara, “Information Technology for the Health Professions”, Prentice Hall, 2006.
4. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.

COURSE OUTCOMES:

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

1. Design and develop clinical and hospital management system on his own.
2. Work with different medical imaging techniques.
3. Apply the knowledge of bio informatics for biological databases. Learn hybrid representations and its Applications.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓			✓			
CO2	✓	✓	✓			✓	✓	✓		
CO3		✓	✓					✓	✓	✓

ITEE X0X	**TEXT MINING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the basic issues and types of text mining.
- To appreciate the different aspects of text categorization and clustering.
- To understand the role played by text mining in Information retrieval and extraction.
- To appreciate the use of probabilistic models for text mining.
- To appreciate the current trends in text mining.

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Preprocessing– Types of Problems- basics of document classification- information retrieval-clustering and organizing documents- information extraction- prediction and evaluation-Textual information to numerical vectors -Collecting documents-document standardization-tokenization- lemmatization- vector generation for prediction- sentence boundary determination -evaluation performance.

Text Categorization – Definition – Document Representation –Feature Selection - Decision Tree Classifiers - Rule-based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers- Classification of Linked and Web Data - Meta-Algorithms– Clustering – Definition- Vector Space Models - Distance-based Algorithms- Word and Phrase-based Clustering -Semi-Supervised Clustering - Transfer Learning.

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity-web based document search- matching- inverted lists- evaluation. Information extraction Architecture - Co-reference - Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations - Pattern Extraction - A priori Algorithm – FP Tree algorithm.

Probabilistic Models for Text Mining -Mixture Models - Stochastic Processes in Bayesian Nonparametric Models - Graphical Models - Relationship Between Clustering, Dimension Reduction and Topic Modeling - Latent Semantic Indexing - Probabilistic Latent Semantic Indexing -Latent Dirichlet Allocation- Interpretation and Evaluation - Probabilistic Document Clustering and Topic Models - Probabilistic Models for Information Extraction - Hidden Markov Models - Stochastic Context-Free Grammars - Maximal Entropy Modeling - Maximal Entropy Markov Models -Conditional Random Fields.

Visualization Approaches - Architectural Considerations - Visualization Techniques in Link Analysis - Example- Mining Text Streams - Text Mining in Multimedia - Text Analytics in Social Media - Opinion Mining and Sentiment Analysis - Document Sentiment Classification - Opinion Lexicon Expansion - Aspect-Based Sentiment Analysis - Opinion Spam Detection – Text Mining Applications and Case studies.

REFERENCES:

1. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Springer, paperback 2010.
2. Ronen Feldman, James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data"-Cambridge University press, 2006.
3. Charu C. Aggarwal ,ChengXiang Zhai, "Mining Text Data", Springer, 2012.
4. Weiss, S.M., Indurkhya, N., Zhang, T., Damerau, F, "Text Mining Predictive Methods for Analyzing Unstructured Information", Springer 2004.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Understand the basic concepts of text mining in Information retrieval and extraction.
2. Apply probabilistic models for text mining.
3. Learn the current trends in text mining.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓				✓			✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓		
CO3		✓	✓					✓	✓	✓

ITEE X0X	**MACHINE LEARNING TECHNIQUES**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the concepts of machine learning.
- To appreciate supervised and unsupervised learning and their applications.
- To understand the theoretical and practical aspects of Probabilistic Graphical Models.
- To appreciate the concepts and algorithms of reinforcement learning.
- To learn aspects of computational learning theory.

Machine Learning - Machine Learning Foundations –Overview – Applications - Types of Machine Learning - Basic Concepts in Machine Learning - Examples of Machine Learning - Applications Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition-Bayesian Linear Regression-Bayesian Model Comparison.

Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression - Decision Trees Classification Trees - Regression Trees – Pruning - Neural Networks - Feed-Forward Network Functions - Error Back-Propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble methods - Bagging - Boosting.

Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model Selection for Latent Variable Models - High-Dimensional Spaces -- The Curse of Dimensionality, Dimensionality Reduction - Factor Analysis - Principal Component Analysis - Probabilistic PCA Independent Components Analysis.

Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties – From Distributions to Graphs - Examples - Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes Classifiers - Markov Models – Hidden Markov Models – Inference – Learning- Generalization – Undirected graphical models - Markov Random Fields- Conditional Independence Properties - Parameterization of MRFs - Examples - Learning – Conditional Random Fields (CRFs) - Structural SVMs.

Sampling – Basic sampling methods – Monte Carlo - Reinforcement Learning - K-Armed Bandit- Elements - Model-Based Learning - Value Iteration- Policy Iteration - Temporal Difference Learning- Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces- Generalization- Partially Observable States- The Setting-Example - Semi-Supervised Learning - Computational Learning Theory - Mistake Bound Analysis – Sample Complexity Analysis - VC Dimension - Occam Learning - Accuracy and Confidence Boosting.

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008.
6. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009.

COURSE OUTCOMES:

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

1. Implement a neural network for an application of your choice using an available tool.
2. Implement probabilistic discriminative and generative algorithms for an application of your choice.
3. Analyze the results of various models.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓	✓				✓
CO2		✓	✓	✓	✓	✓				
CO3	✓	✓	✓	✓					✓	✓

ITEE X0X	**SOFTWARE RELIABILITY ENGINEERING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand and apply Reliability Mathematics to hardware and software systems.
- To understand evolution of software reliability growth models.
- To understand and apply Non-homogeneous Poisson Software Reliability Growth Models.

Review of Reliability Mathematics–Random Experiment-Probability Distributions Binomial-Poisson-Exponential-Weibul and Generalized Exponential Distributions Reliability Block Diagram-System Reliability-Repairable and Non- Repairable systems Maintainability and Availability-MTBF-MTTF-MDT-MTTR-Designing for higher reliability-Redundancy-k out of n systems.

Basic Concepts – Failure and Faults-Introduction to Software Reliability Growth Models (SRGMs)-General Model Characteristic-Historical Development of modelsModel Classification scheme-white box and black box models-models for application during operational phase and testing phase-Markovian models-Jelinski-Moranda model-Goel-Okumoto imperfect debugging model.

Stochastic process-Counting Process-NHPP-Execution Time-Testing time and Calendar Time modeling-Musa models-Basic Execution time-Musa-Okumoto Logarithmic Poisson Execution time models-NHPP models-Goel-Okumoto-Yamada delayed S-shaped model-Log power model-Imperfect debugging models-Kapur-Garg model.

Flexible models-Goel Generalized NHPP-S-G GENHPP- SG We NHPP models Quality metrics producing models- S-G-K (2007) model and S-G-K (2012) model Failure Data-Parameter estimation-MLE and Least squares techniques-Use of tools Comparison Criteria-Goodness of fit - Predictive Validity of Models-short term and long term.

Bayesian models-Littlewood-Verall model-Discrete Models-Efforts based models Release Time determination-criteria-cost-failure intensity-reliability.

REFERENCES:

1. John D. Musa, Anthony Iannino, Kazuhira Okumoto, "Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology", McGraw Hill, 1987.
2. John D. Musa, "Software Reliability Engineering", Tata McGraw Hill, 1999.
3. Patric D. T.O Connor, "Practical Reliability Engineering", 4th Edition, John Wesley & sons, 2003.
4. M.Xie, "Software Reliability Modelling", World Scientific, Singapore, 1991.

COURSE OUTCOMES:

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

1. Understand the need for flexible models.
2. Understand the quality metrics producing models.
3. Understand Determination of Software Release Time.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓	✓				✓	✓
CO2		✓	✓	✓	✓	✓	✓			
CO3	✓	✓						✓	✓	✓

ITEE X0X	**3G AND 4G WIRELESS NETWORKS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn various generations of wireless and cellular networks.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.

Introduction: History of Mobile Cellular Systems - First Generation - Second Generation - Generation 2.5 - Overview of 3G & 4G. 3GPP and 3GPP2 standards.

Evolution from GSM, 3G Services and Applications - UMTS network structure - Core network - UMTS Radio access - HSPA – HSUPA- HSDPA- CDMA 1X – WCDMA.

LTE: Introduction, Radio interface architecture - Physical layer, Access procedures - System Architecture Evolution (SAE) - Communication protocols – Interfaces- LTE Advanced.

Introduction to WiMax Networks– IEEE 802.16 – Frame Format – Protocols - OFDM – MIMO - IEEE 802.20 – Applications.

Introduction and Evolution - Applications of DLNA and NFC – DLNA Architecture and Protocol stack - Smart phone and NFC – Mobile Commerce and NFC – NFC tags –Security Issues – Femtocells from the network operators and user"s point of view.

REFERENCES:

1. Juha Korhonen, "Introduction to 3G Mobile Communication", Artech House, 2003.
2. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming , "3G Evolution HSPA and LTE for Mobile Broadband", Academic Press, 2008.
3. Flavio Muratore, "UMTS Mobile Communication for the Future", John Wiley & Sons, 2001.
4. Harri Holma and Antti Toskala, "HSDPA/HSUPA for UMTS", Johan Wiley & Sons, 2006.
5. Martin Sauter, "3G & 4G & Beyond: Bringing Networks, Devices and the Web together", second edition, Wiley, 2013.

COURSE OUTCOMES:

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

1. Understand about Wi MAX networks, protocol stack and standards.
2. Understand about the emerging trends of smart phones.
3. Understand the evolution of latest standards like DLNA, NFC and femtocells.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓						
CO2		✓	✓	✓	✓				✓	
CO3	✓	✓	✓				✓	✓	✓	✓

ITEE X0X	**BIOMETRIC IMAGE PROCESSING**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the basic concepts and algorithms of digital processing.
- To familiarize the student with the image processing environments like MATLAB and its equivalent Biometric Image processing environments.
- To expose the students to a broad range of Biometric image processing techniques and issues and their applications, and to provide the student with practical experiences using them.

Digital Image representation - Fundamental steps in Image Processing - Elements of Digital Image Processing Systems - Sampling and Quantization - Basic relationships between pixels - Imaging Geometry - Transformation Technology - The Fourier Transform, The Hadamard Transform, The Discrete Cosine Transform. Image Enhancement: The Spatial Domain Methods, The Frequency Domain Methods - Image Segmentation: Pixel Classification by Thresholding, Histogram Techniques, Smoothing and Thresholding - Gradient Based Segmentation: Gradient Image, Boundary Tracking, Laplacian Edge Detection.

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

Detection and Location of Faces: Statistics-Based method, Knowledge-Based method - Feature Extraction and Face Recognition: Gray value Based method, Geometry Feature Based method, Neural Networks method.

Iris System Architecture, Definitions and Notations - Iris Recognition: Iris location, Doubly Dimensionless Projection, Iris code, Comparison - Coordinate System: Head Tilting Problem, Basic Eye Model, Searching Algorithm - Texture Energy Feature.

Introduction to Multibiometric - Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics - Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion.

REFERENCES:

1. David D. Zhang, "Automated Biometrics: Technologies and Systems", Kluwer AcademicPublishers, New Delhi, 2000.
2. Rafael C.Gonzalez, Richard E.Woods, Steven L.Eddins, "Digital Image Processing", Pearson Education, New Delhi, 2009.
3. Arun A. Ross, Karthik Nandakumar, A.K.Jain, "Handbook of Multibiometrics", Springer, New Delhi, 2006.
4. Pushpa Dhamala, "Multibiometric systems", MS thesis, Institute for telematikk, 2012.
5. Anil K Jain, Patrick Flynn, Arun A Ross, "Handbook of Biometrics", Springer, 2008.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Design an application that incorporates different concepts of Biometric Image processing.
2. Apply and explore new techniques in the areas of Biometric image enhancement, restoration, segmentation, compression, wavelet processing and image morphology.
3. Explore the possibility of Appling Biometric image processing concepts in various domains.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓			✓			✓	
CO2	✓	✓	✓	✓	✓				✓	✓
CO3	✓	✓						✓	✓	

ITEE X0X	BIOMETRIC SECURITY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To provide scientific foundations needed for the design, implementation, and evaluation of large scale biometric identification systems.

Biometrics- Introduction- benefits of biometrics over traditional authentication systems - benefits of biometrics in identification systems-selecting a biometric for a system – Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems.

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern - Technical description – characteristics - strengths – weaknesses –deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics.

Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics - signature and handwriting technology - Technical description – classification - keyboard / keystroke dynamics - Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses- deployment.A

Multi biometrics: Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation Plan.

Case studies on Physiological, Behavioral and multifactor biometrics in identification systems.

REFERENCES:

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, “Biometrics -Identity verification in a network”, Wiley Eastern, 2002.
2. John Chirillo and Scott Blaul,” Implementing Biometric Security”, Wiley Eastern Publications, 2005.
3. John Berger,” Biometrics for Network Security”, Prentice Hall, 2004.
4. John D. Woodward, Jr. Nicholas M. Orlans Peter T. Higgins, “Biometrics”, dreamtech, 2003.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Design biometric identification systems.
2. Implementation of biometric identification systems.
3. Evaluation of large scale biometric identification systems.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓		✓			✓	
CO2	✓	✓					✓	✓		
CO3		✓	✓	✓	✓				✓	✓

ITEE X0X	**DISTRIBUTED SYSTEMS SECURITY**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To explore the design and implementation of distributed systems.

Introduction – Distributed Systems, Distributed Systems Security. Security in Engineering: Secure Development Lifecycle Processes - A Typical Security Engineering Process - Security Engineering Guidelines and Resources. Common Security Issues and Technologies: Security Issues, Common Security Techniques.

Host-level Threats and Vulnerabilities: Transient code Vulnerabilities - Resident Code Vulnerabilities - Malware: Trojan Horse – Spyware - Worms/Viruses – Eavesdropping - Job Faults. Infrastructure-Level Threats and Vulnerabilities: Network-Level Threats and Vulnerabilities - Grid Computing Threats and Vulnerabilities – Storage Threats and Vulnerabilities – Overview of Infrastructure Threats and Vulnerabilities.

Application-Layer Vulnerabilities - Injection Vulnerabilities - Cross-Site Scripting (XSS) - Improper Session Management - Improper Error Handling - Improper Use of Cryptography - Insecure Configuration Issues - Denial of Service - Canonical Representation Flaws - Overflow Issues. Service-Level Threats and Vulnerabilities: SOA and Role of Standards - Service-Level Security Requirements - Service-Level Threats and Vulnerabilities - Service-Level Attacks - Services Threat Profile.

Sandboxing – Virtualization - Resource Management - Proof-Carrying Code -Memory Firewall – Antimalware. Infrastructure-Level Solutions: Network-Level Solutions - Grid-Level Solutions - Storage-Level Solutions. Application-Level Solutions: Application-Level Security Solutions.

Services Security Policy - SOA Security Standards Stack – Standards in Dept - Deployment Architectures for SOA Security - Managing Service-Level Threats - Compliance in Financial Services - SOX Compliance - SOX Security Solutions - Multilevel Policy-Driven Solution Architecture - Case Study: Grid - The Financial Application - Security Requirements

Analysis. Future Directions - Cloud Computing Security – Security Appliances - Usercentric Identity Management - Identity-Based Encryption (IBE) - Virtualization in Host Security.

REFERENCES:

1. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni and Srikanth Sundarrajan, "Distributed Systems Security: Issues, Processes and Solutions", Wiley Ltd. Publications, 2009.
2. Yang Xiao and Yi Pan, "Security in Distributed and Networking Systems", World Scientific Publishing Company, 2007.
3. Rachid Guerraoui and Franck Petit, "Stabilization, Safety, and Security of Distributed Systems", Springer, 2010.
4. Andrew S. Tanenbaum, and Maarten Van Steen, Distributed systems: principles and paradigms. Prentice-Hall, 2007.
5. Oldooz Karimi, "Security model for service-oriented architecture." arXiv preprint arXiv:1108.1314, 2011.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Understand the computer system security.
2. Understand the Security Appliances and Virtualization.
3. Understand the Services Security Policy.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓			✓			✓	
CO2	✓	✓	✓	✓	✓				✓	✓
CO3	✓	✓						✓	✓	

ITEE X0X	**WIRELESS SECURITY**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To gain and understand the complete knowledge of threats within wireless environments.
- To recognize typical vulnerabilities and safeguards for wireless communication to include; Cellular and Personal Communications Services (PCS) network security, secure wireless encrypted e-mail solution, Wireless handheld device security, PAN and LAN security.

Introduction to wireless technologies- Wireless data networks-Personal Area Networks - Transmission Media – WLAN standards - Securing WLANS - Countermeasures - WEP (Wired Equivalence Protocol).

Kinds of security breaches - Eavesdropping - Communication Jamming - RF interference - Covert wireless channels - DOS attack – Spoofing - Theft of services - Traffic Analysis - Cryptographic threats - Wireless Security Standards.

Wireless Device security issues - CDPD security (Cellular Digital Packet Data)-GPRS security (General Packet Radio Service) - GSM (Global System for Mobile Communication) security – IP security.

Secure Socket Layer - Wireless Transport Layer Security - WAP Security Architecture - WAP Gateway.

Basic specifications – Piconets – Bluetooth security architecture – Scatternets – Security at the baseband layer and link layer – Frequency hopping – Security manager – Authentication – Encryption – Threats to Bluetooth security.

REFERENCES:

1. Nichols and Lekka, “Wireless Security-Models, Threats and Solutions”, Tata McGraw – Hill, New Delhi, 2006.
2. Merritt Maxim and David Pollino, “Wireless Security”, Osborne/McGraw Hill, New Delhi, 2005.
3. William Stallings, “Cryptography and Network Security - Principles and practices, Prentice Hall, New Delhi, 2006.
4. Randall, K. Nichols, and Panos C. Lekkas. "Wireless security: models, threats, and solutions." MacGraw-Hill, New York (2002).

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Understand the complete knowledge of threats within wireless environments.
2. Understand the Wireless Device security issues.
3. Understand the basic specifications, Bluetooth security.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓				✓	✓	
CO2	✓	✓	✓		✓	✓			✓	✓
CO3	✓	✓	✓					✓	✓	✓

ITEE X0X	SPEECH PROCESSING AND SYNTHESIS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the mathematical foundations needed for speech processing.
- To understand the basic concepts and algorithms of speech processing and synthesis.
- To familiarize the students with the various speech signal representation, coding and recognition techniques.
- To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing.

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing– Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

REFERENCES:

1. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, “Spoken Language Processing – A guide to Theory, Algorithm and System Development”, Prentice Hall PTR, 2001.
2. Thomas F.Quatieri, “Discrete-Time Speech Signal Processing”, Pearson Education, 2002.
3. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Prentice Hall Signal Processing Series, 1993.
4. Sadaoki Furui, “Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications)”, Marcel Dekker, 2000.
5. Joseph Mariani, “Language and Speech Processing”, Wiley, 2009.

COURSE OUTCOMES:

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

1. Identify the various temporal, spectral and cepstral features required for identifying speech units – phone, syllable and word.
2. Determine and apply Mel-frequency cepstral coefficients for processing all types of signals.
3. Justify the use of formant and concatenative approaches to speech synthesis.
4. Identify the apt approach of speech synthesis depending on the language to be processed.
5. Determine the various encoding techniques for representing speech.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓			✓	✓		
CO2		✓	✓	✓	✓				✓	
CO3	✓	✓	✓	✓				✓	✓	
CO4		✓	✓	✓	✓	✓				
CO5	✓	✓	✓	✓			✓	✓	✓	✓

ITEE X0X	**SENSING TECHNIQUES AND SENSORS**	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To study the sensor characteristics and the fundamental principles of sensing.
- To understand the sensor interface electronics.
- To study selected motion-related sensors.
- To study light and radiation detectors.
- To study selected temperature sensors.
- To study selected chemical sensors.

Data Acquisition – sensor characteristics – electric charges, fields, potentials – capacitance – magnetism – inductance – resistance – piezoelectric – pyroelectric – Hall effect – thermoelectric effects – sound waves – heat transfer – light – dynamic models of sensors.
Radiometry – Photometry – mirrors – lenses – fibre optics – concentrators – Interface circuits – amplifiers – light-to-voltage – excitation circuits – ADC – Digitization – Capacitance-to-voltage – bridge circuits – data transmission – noise in sensors and circuits – calibration – low power sensors.
Occupancy and motion detectors: ultrasonic – microwave – capacitive detectors – triboelectric – optoelectronic motion sensors – optical presence sensor – Pressure Gradient sensors Velocity and acceleration sensors: Accelerometer characteristics – capacitative accelerometers – piezoelectric accelerometers – piezo resistive accelerometers – thermal accelerometers – Gyroscopes – piezoelectric cables – gravitational sensors.

Light Detectors: Photo diodes – photo transistor – photo resistor – cooled detectors – CCD and CMOS image sensors – thermal detectors – optical design – gas flame detectors
Radiation Detectors: scintillating detectors – ionization detectors – cloud and bubble chambers.

Temperature Sensors: coupling with objects – temperature reference points – thermo resistive sensors – thermo electric contact sensors – semiconductor sensors – acoustic sensors – piezoelectric sensors Chemical sensors: characteristics – classes of chemical sensors – biochemical sensors – multi-sensor arrays – electronic noses and tongues.

REFERENCES:

1. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Fourth Edition, Springer, 2010.
2. Jon Wilson, "Sensor Technology Handbook", 1st Edition, Elsevier, Dec 2004.
3. D.Patranabis, "Sensors and Transducers", Prentice Hall of India, 2004.
4. John Vetelino, AravindReghu, "Introduction to Sensors", CRC Press 2010.
5. John P. Bentley, "Principles of Measurement Systems", 4th Edition,Pearson Education, 2005.
6. E.A. Doebelin, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2012.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Explain sensor characteristics, physics of sensors, optical components of sensors.
2. Apply sensor interface electronics.
3. Choose and use appropriate motion-related sensors, appropriate light and radiation detectors, appropriate temperature sensors, appropriate chemical sensors.

Mapping with Programme Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓	✓						✓
CO2		✓	✓	✓	✓	✓			✓	✓
CO3	✓	✓	✓				✓			

ITEE X0X	WEB INTEGRATED TECHNOLOGIES	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.
- To learn the concept of three tier application using MVC.

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.

Web Technology Basics – HTML5 – Cascading Style Sheet – Client side scripting – JavaScript – JavaScript 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.

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.

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 - Struts – Hibernate – Spring.

SOA Principles – Evolution of SOA – SOA and WS_Extension – Service Activity – Coordination – Transaction – Orchestration – Choreography – Security – Advanced Messaging - Notification and Eventing - Case Studies – Current Trends.

REFERENCES:

1. Gustavo Rossi, Oscar Pastor, Daniel Schwabe, Luis Olsina, “Web Engineering Modeling and Implementing web Applications”, Springer, 2008.
2. Thomas Erl, “Service Oriented Architecture, Concepts, Technology, and Design”, Pearson,2005.
3. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.
4. Freunk P.Coyle, XML, web Services and the Data Revolution, Pearson, 2002.
5. C. Xavier, “Web Technology & Design”, New Age International, 2007.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to perform the

1. Design and development of web applications using various models.
2. Web application development using HTML and scripting technologies.
3. Web application development using advanced features.

ITEE X0X	DECISION MANAGEMENT SYSTEMS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand how Decision Management Systems can transform the business.
- To plan the systems with the decision in mind.
- To identify, model and prioritize the decisions.

Principles of Decision Management Systems - Begin with the Decision in Mind - Be Transparent and Agile - Be Predictive, Not Reactive - Test, Learn, and Continuously Improve.

Building Decision Management Systems - Discover and Model Decisions - Characteristics of Suitable Decisions - A Decision Taxonomy - Finding Decisions - Documenting Decisions Prioritizing Decisions.

Design and Implement Decision Services - Build Decision Services - Integrate Decision Services - Best Practices for Decision Services Construction - Monitor and Improve Decisions - What Is Decision Analysis? - Monitor Decisions - Determine the Appropriate Response - Develop New Decision-Making Approaches - Confirm the Impact Is as Expected - Deploy the Change.

Enablers for Decision Management Systems - People Enablers - The Three-Legged Stool - A Decision Management Center of Excellence - Organizational Change - Process Enablers - Managing a Decision Inventory - Adapting the Software Development Lifecycle - Decision Service Integration Patterns - Moving to Fact-Based Decisioning - The OODA Loop - Technology Enablers.

Business Rules Management Systems - Predictive Analytics Workbenches - Optimization Systems - Pre-Configured Decision Management Systems - Data Infrastructure - A Service Oriented Platform.

REFERENCES:

1. James Taylor, Decision Management Systems-A Practical guide to using Business rules and Predictive Analytics, IBM Press, 2012.
2. Efraim Turban, Jay E. Aronson, Ting-Peng Liang, Decision Support Systems & Intelligent Systems, 9th edition, Prentice Hall, 2010.
3. Alberto Cordoba, Understanding the Predictive Analytics Lifecycle, Wiley, 2014.
4. Eric Siegel, Thomas H. Davenport, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2013.
5. George M Marakas, Decision support Systems, 2nd Edition, Pearson/Prentice Hall, 2002
6. V.S. Janakiraman, K. Sarukesi, ―Decision Support Systems", PHI, ISBN8120314441, 9788120314443, 2004.
7. Efrem G Mallach, ―Decision Support systems and Data warehouse Systems, McGraw Hill, thirteenth reprint, 2008.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to

1. Design and implement robust decision services.
2. Monitor ongoing decision-making.
3. Learn methods to improve decision making performance.

ITEE X0X	CYBER FORENSICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To study the fundamentals of computer forensics.
- To have an overview of techniques for Data Recovery and Evidence Collection.
- To study various threats associated with security and information warfare.
- To study the tools and tactics associated with cyber forensics.

Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services.

Data Recovery Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.

Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies.

Arsenal – Surveillance Tools - Hackers and Theft of Components - Contemporary Computer Crime Identity Theft and Identity Fraud - Organized Crime & Terrorism Avenues Prosecution and Government Efforts - Applying the First Amendment to Computer Related Crime - The Fourth Amendment and Other Legal Issues.

Developing Forensic Capabilities - Searching and Seizing Computer Related Evidence - Processing Evidence and Report Preparation - Future Issues.

REFERENCES:

1. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Volume1, Cengage Learning, 2005.
2. Marjie T Britz , “Computer Forensics and Cyber Crime: An Introduction”, 3/E,Pearson Education, 2013.
3. Marie-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Publishers, 2011.
4. Chad Steel, “Windows Forensics”, Wiley India, 2006.
5. Majid Yar, “Cybercrime and Society”, Sage Publications, 2006.
6. Robert M Slade, “Software Forensics”, Tata Mc Graw Hill, 2004.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to

1. Apply the concepts of computer forensics.
2. Handle threats associated with security and information warfare.
3. Design tools and tactics associated with cyber forensics.

ITEE X0X	DATA SCIENCE AND ANALYTICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To know the fundamental concepts of data science and analytics.
- To learn various techniques for mining data streams.
- To learn Event Modelling for different applications.
- To know about Hadoop and Map Reduce procedure.

Introduction to Data Science – Applications - Data Science Process – Exploratory Data analysis –Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics.

Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques – Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.

REFERENCES:

1. XMichael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets” Cambridge University Press, 2012.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & Sons, 2012.
4. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008**.**

5. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly Publishers, 2013.
6. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly Publishers, 2013.
7. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications“, Wiley Publishers, 2014.
8. S. N. Sivanandam, S. N Deepa, “Introduction to Neural Networks Using Matlab 6.0”, Tata McGraw- Hill Education, 2006.

COURSE OUTCOMES:

Upon the completion of the course the student should be able to

1. Work with big data platform and its analysis techniques.
2. Design efficient algorithms for mining the data from large volumes.
3. Apply hadoop architecture.

ITEE X0X	PATTERN RECOGNITION	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To introduce the theoretical fundamentals of recognition.
- To examine variety of recognition models ranging from simple to the more sophisticated.

Review of probability theory: conditional probability, Bayes theorem, random variables, distribution function, expectation and variance, joint distribution function of multiple random variables, normal distribution.

Introduction to pattern recognition system, design cycle, introduction to feature extraction and classification, types of learning. Bayesian decision theory, Bayes Classifier, Discriminant functions, Minimum-error-rate classification.

Parameter estimation methods, Maximum-Likelihood estimation, Gaussian mixture models, Bayesian estimation, Expectation maximization method, Hidden Markov models, Dimension reduction methods, Fisher discriminant analysis, Principal component analysis.

Non-parametric techniques for density estimation and pattern classification, Parzen-window method, K-Nearest Neighbour method, linear discriminant analysis, Support vector machines.

Unsupervised learning and clustering, linear least square regression, Criterion functions for clustering, Algorithms for clustering: Hierarchical and other methods, Cluster validation.

REFERENCES:

1. S. M. Ross, Introduction to Probability models, Academic Press, 2010.
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. Nasrabadi, Nasser M. "Pattern recognition and machine learning." Journal of electronic imaging 16.4 (2007): 049901.
5. Anzai, Yuichiro. Pattern recognition and machine learning. Elsevier, 2012.
6. Fu, K. C., ed. Sequential methods in pattern recognition and machine learning. Vol. 52. Academic press, 1968.

COURSE OUTCOMES:

Upon completion of this course the student will be able to

1. Develop the necessary analytical skills and experiences on pattern recognition

ITEE X0X	HUMAN COMPUTER INTERACTION	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the principles and fundamentals of human computer interaction (HCI).
- To analyze HCI theories, as they relate to collaborative or social software.
- To establish target users, functional requirements, and interface requirements for a given computer application.
- To understand user interface design principles, and apply them to designing an interface.
- To learn user interface designs through usability inspection and user models.
- To know the applications of multimedia on HCI.

Humans – Information Process – Computer – Information Process – Differences and Similarities – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive Systems – Usability – Paradigm shift – Interaction Design Basics – Design Process – Scenarios – Users Need – Complexity of Design.

Software Process – Usability Engineering – Issue based Information Systems – Iterative Design Practices – Design Rules – Maximum Usability – Principles – Standards and Guidelines – Design Patterns – Programming Tools – Windowing Systems – Interaction Tool Kit – User Interface Management System – Evaluation Techniques – Evaluation Design – Evaluating Implementations – Observational Methods.

Universal Design Principles – Multimodal Systems – User Support – Presentation and Implementation Issues – Types – Requirements – Approaches – Cognitive Model – Hierarchical Model – Linguistic Model – Physical and Device Models – Socio technical Models – Communication and Collaboration Models – Task Models – Task Analysis And Design.

Basic Design Structure – Single Independent Variable – Multiple Independent Variable – Factorial Design – Split-Plot Design – Random Errors – Experimental Procedure – Statistical Analysis – T Tests – Analysis of Variance Test – Regression – Chi-Square Test – Survey – Probabilistic Sampling – Non-Probabilistic Sampling – Developing Survey Questions.

Dialogue Notations and Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual - Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship with Dialogue – Formalisms – Formal Notations – Interstitial Behavior – Virtual Reality – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor-based Systems – Groupware – Applications – Ubiquitous Computing – Virtual Reality.

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1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Fifth Edition, Addison-Wesley Publishing Co, 2009.
4. Smith-Atakan, Serengul. Human-computer interaction. Cengage Learning EMEA, 2006.
5. Rogers, Yvonne, Helen Sharp, and Jenny Preece. Interaction design: beyond human-computer interaction. John Wiley & Sons, 2011.

COURSE OUTCOMES:

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

1. Interpret the contributions of human factors and technical constraints on human-computer interaction.
2. Evaluate the role of current HCI theories in the design of software.
3. Apply HCI techniques and methods to the design of software.
4. Categorize and carefully differentiate various aspects of multimedia interfaces.
5. Design and develop issues related to HCI for real application.

ITEE X0X	SOFT COMPUTING AND APPLICATIONS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the concept and applications of fuzzy logic, neural networks, genetic algorithms and hybrid systems.

Introduction to Soft Computing - Components of Soft Computing - Importance of Soft Computing - Fuzzy Set Theory - Different types of fuzzy set Membership Functions - Fuzzy Set theoretic operations - Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems.

Basic concepts of neural networks - Supervised Learning, Unsupervised Learning - Neural network architectures - Learning methods - Architecture of a back propagation network.

Basic concepts of genetic algorithms - encoding - genetic modeling -Evolutionary Strategies - Optimization techniques.

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling - Integration of neural networks, fuzzy logic and genetic algorithms.

Applications of Fuzzy Logic - Applications of Neural Network - Application of Genetic Algorithm - Applications in Image processing- Applications in Data mining - Applications in other domains.

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1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.

2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.
4. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
5. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.

COURSE OUTCOMES:

Upon completion of the course, the student should be able

1. Implement the concept and applications of fuzzy logic, neural networks, genetic algorithms and hybrid systems.
2. Understand the basic concepts of genetic algorithms.
3. Learn the Applications of Fuzzy Logic.

ITEE X0X	MOBILE APPLICATION DEVELOPMENT	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn the characteristics of mobile applications.
- To understand the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.

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

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

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

Intents and Services – Storing and Retrieving data – Communication via the Web – Notification and Alarms – Graphics and Multimedia – Telephony – Location based services – Packaging and Deployment – Security and Hacking.

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

REFERENCES:

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

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

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Develop mobile applications.
2. Understand the Intents and Services.
3. Understand the Google Android Platform.

ITEE X0X	INFORMATION RETRIEVAL	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the basics of Information Retrieval with pertinence to modeling, Query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.

Introduction - Goals and history of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR – Basic IR Models Boolean and vector space retrieval models – Ranked Retrieval – Text similarity metrics –TF IDF (term frequency/inverse document frequency) weighting - Cosine Similarity.

Basic Tokenizing - Indexing and Implementation of Vector Space Retrieval - Simple tokenizing – stop word removal and stemming – Inverted Indices –Efficient processing with sparse vectors – Query Operations and Languages - Relevance feedback – Query expansion – Query languages.

Experimental Evaluation of IR Performance Metrics Recall, Precision and F measure – Evaluations on benchmark text collections - Text Representation - Word statistics – Zipf's law – Porter stemmer - Morphology – Index term Selection using thesauri -Metadata and markup languages- Web Search engines – spidering – metacrawlers – Directed spidering – Link analysis shopping agents.

Text Categorization and Clustering - Categorization algorithms - Naive Bayes – Decision trees and nearest neighbor- Clustering algorithms - Agglomerative clustering – k Means – Expectation Maximization (EM) - Applications to information filtering – Organization and relevance feedback.

Recommender Systems - Collaborative filtering - Content based recommendation of documents and products - Information Extraction and Integration - Extracting data from text – XML – semantic web – Collecting and integrating specialized information on the web.

REFERENCES:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2008.

2. Ricci, F. Rokach, L. Shapira, B. Kantor, P.B. "Recommender Systems Handbook", 1st Edition, 2011.
3. Brusilovsky, Peter, "The Adaptive Web Methods and Strategies of Web Personalization", Springer, 2007.
4. Baeza-Yates, Ricardo, and Berthier Ribeiro-Neto. Modern information retrieval. Vol. 463. New York: ACM press, 1999.
5. Crestani, Fabio, Mounia Lalmas, and Cornelis Joost van Rijsbergen, eds. Information Retrieval: Uncertainty and Logics: Uncertainty and Logics: Advanced Models for the Representation and Retrieval of Information. Vol. 4. Springer Science & Business Media, 1998.
6. Heiner Stuckenschmidt, Frank van Harmelen, "Information Sharing on the Semantic Web", Springer International Edition, ISBN 3-540-20594-2, 2005.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Understand the various applications of Information Retrieval such as Multimedia IR, Web Search.
2. Understand the concepts of digital libraries
3. Understand the collecting and integrating specialized information on the web.

ITEE X0X	MIDDLEWARE FOR COMMUNICATIONS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the middleware technologies and communication protocols for distributed, dependable, and real-time systems.
- To understand the middleware and/or communication protocols.
- To understand a distributed architecture according to distributed communication requirements.
- To understand real-time communication protocols for distributed dependable systems.
- To understand middleware approaches for WSN.

Introduction, what is Middleware, The Evolution of Middleware, Overview of Middleware, Limitations of Conventional Middleware, Middleware Challenges, Categories of middleware: Message oriented middleware.

Transaction Processing Fundamentals Isolation Levels, Optimistic Concurrency Control, Transaction APIs, Container Managed Transactions, Messaging Transactions, Queued Transaction Processing, Web Transactions, Advanced Transactions.

Peer-to-Peer Middleware Peer-to-peer & Grids, Lack of Peer-to-peer Middleware, Peer Groups, Services & Modules, Protocols, Messages & pipes, Security, Quality of Service, Applications using and Enhancing Grid Middleware.

Model Driven Middleware Overview of the OMG Model Driven Architecture (MDA), Capabilities of the MDA, Benefits of the MDA, Overview of Model Driven Middleware, Limitations of Using Modeling and Middleware in Isolation, Combining Model Driven Architecture and QoS-enabled Component Middleware.

Real-time CORBA Middleware: DRE System Technology Challenges, Challenges of Today's DRE Systems, Challenges of Future DRE Systems, Limitations with Conventional DRE System Development, Overview of Real-time CORBA, Overview of CORBA, Overview of Real-time CORBA 1.0, Overview of Real-time CORBA 2.0.

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1. K. Sohraby, D. Minoli, and T. Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley & Sons, March 2007.
2. Qusay H. Mahmoud, "Middleware for Communications", John Wiley & Sons, 2004.
3. Misra Sudip, Woungam, Isaac Misra, Subhas Chandra, "Guide to wireless sensor networks", Computer Communications and networks Springer link Verlag, 2009.
4. Luis Redondo-López, Aggeliki Prayati, Juan-Manuel LópezNavarro, José-Fernán Martínez-Ortega and Ana-Belén García-Hernando, "Problem solving for wireless sensor networks", Springer Verlag, 2008.
5. Levente Buttyan,Dennis Gessner,Alban Hessler, Peter Langendoerfer "Application of wireless sensor networks in critical infrastructure protection: Challenges and design options", IEEE Wireless Communications, Vol 14 issue 5, Pg.44-49 ,October 2010.
6. Tarik Taleb,Dario Bottazzi and Nidal Nasser, " A Novel Middleware Solution to Improve Ubiquitous Healthcare Systems Aided by Affective Information", IEEE Transactions on Information Technology in Biomedicine,Vol.14,No.2,March 2010.
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12. Miaomiao, Jiannong Cao, Jing Li and Sajal K Dasi, "Middleware for Wireless Sensor networks", Journal of Computer Science and Technology, Springer link, Volume no 23, number 3, 305-326, May 2008.
13. References - http://www.dre.vanderbilt.edu/~schmidt/PDF/.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Implement the middleware technologies.
2. Implement the communication protocols for distributed communications.
3. Implement the real-time systems.
4.