w.e.f. 2017-18

M.TECH-15

M. Tech.

COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

Department of Computer Science and Engineering

M. Tech. CSE Programme Accredited by NBA

VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous, ISO 9001:20015 Certified Institution)

(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)

(Sponsored by Siddhartha Academy of General & Technical Education)

Kanuru, Vijayawada

Andhra Pradesh - 520007, INDIA.

www.vrsiddhartha.ac.in

PROGRAM EDUCATIONAL OBJECTIVES

The Graduates of the M.Tech.(CSE) Program

I. Will solve wide range of computing related problems to fulfil the needs of industry and society.

II. Will have successful careers in academia, research and industry.

III. Will communicate effectively, work in collaboration and practice the profession in accordance with professional standards and ethical practices.

PROGRAMME OUTCOMES

PO1 An Ability to independently carryout research/ investigation and development work to solve Practical Problems. [Problem solving and Research skills]

PO2 An ability to write and present a substantial technical report/document. [Communication]

PO3 Able to demonstrate a degree of mastery over the area as per the specialization of the program. [Lifelong Learning]

PROGRAMME SPECIFIC OUTCOMES

PSO1 An ability to learn the state of art emerging technologies related to computer science and apply the learned concepts in related fields

PSO2 Have a clear understanding of professional and ethical responsibility

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(Autonomous)

Kanuru, Vijayawada – 520 007

(Approved by AICTE, Accredited by NAAC with 'A' Grade, and ISO 9001: 2015 Certified)

(Affiliated to Jawaharlal Nehru Technological University, Kakinada)

Academic Regulations for M. Tech (M.TECH-15) w. e. f: 2017-2018

(Common to all branches)

1. INTRODUCTION

Academic Programmes of the College are governed by rules and regulations as approved by the Academic Council, which is the highest Academic Body of the Institute. These academic rules and regulations are effective from the academic year 2015-16, for students admitted into two year PG programme offered by the college leading to Master of Technology (M. Tech).

The regulations listed under this head are common for postgraduate programmes, leading to award of M. Tech degree, offered by the college with effect from the academic year 2015-16 and they are called as "M.TECH-15" regulations.

The regulations hereunder are subjected to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the programme, as may be decided by the Academic Council.

2. DEFINITIONS

a) "Commission" means University Grants Commission (UGC)

b) "Council" means All India Council for Technical Education (AICTE)

c) "University" means Jawaharlal Nehru Technological University Kakinada, Kakinada (JNTUK)

d) "College" means Velagapudi Ramakrishna Siddhartha Engineering College (VRSEC)

e) "Programme" means any combination of courses and/or requirements leading to the award of a degree

f) "Course" means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g) "Degree" means an academic degree conferred by the university upon those who complete the postgraduate curriculum.

3. PROGRAMMES OFFERED

The nomenclature and its abbreviation given below shall continue to be used for the degree programmes under the University, as required by the Council and Commission.

Master of Technology (M. Tech) Besides, the name of the programme shall be indicated in brackets after the abbreviation. For example PG engineering degree in Computer Science and Engineering is abbreviated as M. Tech (Computer Science and Engineering).

Presently, the college is offering Post Graduate programme in Engineering with the following programmes:

Table 1: List of Programmes offered by college leading to M. Tech Degree

S. No	Programme	Department
1	Structural Engineering	Civil Engineering
2	Computer Science and Engineering	Computer Science and Engineering
3	Power Systems Engineering.	Electrical and Electronics Engineering
4	Communication Engineering and Signal Processing	Electronics and Communication Engineering
5	Telematics	
6	VLSI Design and Embedded Systems	
7	Computer Science & Technology	Information Technology
8	CADCAM	Mechanical Engineering
9	Thermal Engineering	

These Regulations shall be applicable to any new postgraduate programme (M. Tech) that may be introduced from time to time.

4. DURATION OF THE PROGRAMME

- The duration of the programme is two academic years consisting of four semesters.

- A student is permitted to complete the programme within a maximum duration of 4 years.

5. MINIMUM INSTRUCTION DAYS

- Each semester shall consist of a minimum of 90 instruction days with about 25 to 35 contact periods per week.

6. ELIGIBILITY CRITERIA FOR ADMISSION

- The eligibility criteria for admission into M.Tech programme are as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

6.1 CATEGORY –A Seats:

- These seats will be filled by the Convener, PGECET Admissions.

6.2 CATEGORY –B Seats :

- These seats will be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

7. PROGRAMME STRUCTURE

The programme structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their post-graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories to cover the depth and breadth required for the programme and for the attainment of programme outcomes of the corresponding programme.

7.1 Programme Core:

The core consists of set of courses considered necessary for the students of the specific. The courses under this category should satisfy the programme specific criteria prescribed by the appropriate professional societies. The credits for programme core courses is 40.

7.2 Programme Electives:

The electives are set of courses offered in the which covers depth and breadth to further strengthen their knowledge. The students may register for appropriate

electives offered in the based on their area of interest. The credits for the programme electives are 12.

7.3 Independent Learning:

The students are expected to learn the courses offered under this category on their own. The courses offered under this category include:

7.3.1 **Self-Learning Course:**

The self-learning courses shall be taken from the list of approved MOOCs in the respective Board of Studies. The courses under this category shall carry two credits.

7.3.2 **Seminar:**

One seminar shall be delivered by the students as individual presentation. The seminar topics shall be related to the contemporary aspects of the programme. The seminar shall carry 2 credits.

- The self learning course and seminar shall be offered either in 1st year or in 2nd year of the programme depending upon this scheme approved by BOS & Academic Council.

7.3.3 **Project:**

The Project shall be offered in 2nd year of the programme. The project shall be carried out by the students, as individual project, for a minimum period of one academic year. The project shall be carried out in the major areas pertaining to the programme approved by Project Review Committee and may address the societal problems/issues related to the programme. The project shall consist of Part-A and Part-B with a weightage of 10 and 14 credits, respectively spreading over for one semester each. The project part B shall be the extension of project Part A.

- If a candidate wishes to change his/her topic of the project, he/she can do so with approval of the project review committee within one week from the completion of 1st review.

7.3.3.1 PROJECT IN COLLABORATION WITH INDUSTRY:

- A student may, with the approval of the Head of the Department/Centre, visit an industry or a Research Laboratory for data collection, discussion of the project,

experimental work, survey, field studies, etc. during the project period. Projects sponsored by the industry or Research Laboratories will be encouraged and a close liaison with such organizations will be maintained.

- A student may, with the approval of Project Review Committee, do the project work in collaboration with an industry, a Research and Development Organization. A Joint Supervisor may be appointed from the Industry and Research Laboratory with the approval of the HOD. The student shall acknowledge the involvement and / or contribution of an industry, R&D organization in completing the project in his/her thesis and a certificate to this effect, issued by the supervisor from the industrial organization, will be included in the thesis. The Internal Supervisor may visit the industry or the research laboratory in connection with the project work of his / her student if felt necessary.
- It is mandatory for all the students (especially those who do their project in an Industry, R&D organization in India or abroad) to make full disclosure of all data on which they wish to base their project. They cannot claim confidentiality simply because it would come into conflict with the Industry's or R&D laboratory's own interests. Any tangible intellectual property other than copyright of the thesis may have to be assigned to the Institute. The copyright of the thesis itself would however lie with the student as per the IPR policy in force.

7.4 Course Code and Course Numbering Scheme

Course Code consists of Nine characters in which the one is the numeral and second to fourth are alphabets and the rest are numerals.

- The First character '15' indicates year of regulation.
- The second to fourth characters are described in Table 2 and 3.

Table 2: Second to Third Character description

Second & Third Characters	Name of the Department

Second & Third Characters	Name of the Department
CE	Civil Engineering Department
CS	Computer Science and Engineering Department
EC	Electronics & Communication Engineering Department
EE	Electrical & Electronics Engineering Department
IT	Information Technology Department
ME	Mechanical Engineering Department

The fourth and fifth characters represents specialization offering as mentioned in Table No.3.

Table 3: Fourth and Fifth Character description

Fourth & Fifth Characters	Name of the Specialization
SE	Structural Engineering
CS	Computer Science and Engineering
SP	Communication Engineering and Signal Processing
VE	VLSI Design and Embedded Systems
TM	Telematics
PS	Power Systems Engineering
CT	Computer Science & Technology
CC	CADCAM
TE	Thermal Engineering

For all the Sixth and Seventh characters represent semester number and syllabus version number of the course offered.

Eighth character represents course type, as per Table No. 4

Table 4: Course type description

EIGHTH CHARACTER	DESCRIPTION
0	Theory course
5	Lab course

Nineth character represents course number as described in Figure 1 below.

For example, in **15 CSCS 1051** course, the numeral **15** indicates year of regulation and the course is offered by Computer Science and Engineering Department (**CS**) in Computer Science and Engineering specialization offered in the first semester (**1**), the course syllabus version number (**0**), the course is of lab type (**5**) and the course number is (**1**), as given in figure.1 .

15	C	S	C	S	1	0	5	1
Year of Regulation	Department Code		Specialization code		Semester Number	Version Number	Course type	Course Number

Figure 1: Course Code Description

7.5 Scheme of Instruction for 1st and 2nd Years

- The scheme of instruction and exact syllabi of all post graduate programmes are given separately.

7.6 Contact Hours and Credits

Credit means quantifying and recognizing learning. Credit is measured in terms of contact hours per week in a semester.

The Course Credits are broadly fixed based on the following norms:

- Lectures – One Lecture period per week is assigned one credit.
- Tutorials - Two tutorial periods per week are assigned one credit.
- Practical – 2 periods per week is assigned one credit
- Seminar/Mini Project shall have 2 credits.
- Major Project shall have 24 credits.

- However, some courses are prescribed with fixed number of credits depending on the subject complexity and importance.

7.7 Theory / Tutorial Classes

Each course is prescribed with fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed, to give exercises to the students and to closely monitor their learning ability.

7.8 Laboratory Courses

A minimum prescribed number of experiments have to be performed by the students, who shall complete these in all respects and get each experiment evaluated by teacher concerned and certified by the Head of the Department concerned at the end of the semester.

7.9 Programme Credits

Each specialization of M. Tech programme is designed to have a total of 80 credits, and the student shall have to earn all the credits for the award of degree.

8. MEDIUM OF INSTRUCTION

The medium of instruction and examination is English.

9. SYLLABUS

As approved by the concerned BOS and the Academic Council.

10. ELIGIBILITY REQUIREMENT FOR APPEARING SEMESTER END EXAMINATION AND CONDONATION

- A regular course of study means a minimum average attendance of 75% in all the courses computed by totaling the number of periods of lectures, tutorials, practical courses and project as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator.
- Condonation of shortage in attendance may be recommended by the respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

- Students, having shortage of attendance, shall have to pay the requisite fee towards condonation**.**
- Minimum of 50% aggregate marks must be secured by the candidates in the continuous evaluations conducted in that semester for courses such as theory, laboratory courses, seminar and project to be eligible to write semester end examinations. However, if the student is eligible for promotion based on the attendance, in case necessary, a shortage of internal marks up to a maximum of 10% may be condoned by the Principal based on the recommendations of the Heads of the Departments.
- Students having shortage of internal marks up to a maximum of 10% shall have to pay requisite fee towards condonation**.**
- A student, who does not satisfy the attendance and/or internal marks requirement, shall have to repeat that semester.
- Eligible candidates who failed to register for all courses for the semester-end examinations shall not be permitted to continue the subsequent semester and has to repeat the semester for which he/she has not registered for semester end examinations.

11. EXAMINATIONS AND SCHEME OF EVALUATION

11.1 Continuous Evaluation:

11.1.1 Theory Courses

Each course is evaluated for **40** marks (a+b)

a) The continuous evaluation shall be made based on the two midterm examinations each of 2**0** marks will be conducted in every theory course in a semester. The mid term marks shall be awarded giving a weightage of $2/3^{rd}$ in the examination in which the student scores more marks and $1/3^{rd}$ for the examination in which the student scores less marks. Each midterm examination shall be conducted for duration of 90 minutes without any choice**.**

b) The remaining 20 marks are awarded through continuous evaluation of assignments / mini project in each subject as notified by the teacher at the beginning of the semester.

Students shall be informed regarding the comprehensive assignment/ during the first week of the semester and they have to submit completed assignment on or before 12th week of semester.

11.1.2 Laboratory Courses: 40 marks

For Laboratory courses there shall be continuous evaluation during the semester for 40 continuous evaluation marks. The distribution of continues evaluation marks is given below:

Table 5: Distribution of Marks

Sl. No.	Criteria	Marks
1	Day to Day work	10
2	Record	10
3	Continuous Evaluation	20

11.1.3 Seminar: 40 marks

The distribution of continues evaluation marks for the seminar is given below.

Table 6: Distribution of Marks

Sl. No.	Criteria	Marks
1	Report	15
2	Presentation	15
3	Viva-voce	10

The Seminar Review Committee (SRC) to be constituted by HOD with minimum two members related to programs specialization.

11.1.4 Project: (40 marks)

The continuous evaluation (Project Part A and Project Part B) for 40 marks shall be on the basis of two seminars by each student evaluated by a review committee and the day to day assessment by the supervisor in respective semester. The review committee consists of HOD, Programme coordinator, respective internal guide and two senior members of faculty of the department with expertise in the respective specialization nominated by HOD. The distribution of marks is as follows in Table 7.

Table 7: Continuous evaluation in each semester

Sl. No.	Criteria	Marks
1	Two reviews	15+15
2	Day to day assessment	10

Rubrics shall be prepared by review committee using appropriate performance indicators for each review separately and informed to the students well in advance.

11.1.5 Self-Learning Courses

For the courses under this category, there shall be continuous evaluation for 40 marks and semester end examination of 60 marks. The distribution of marks for continuous evaluation will be same as theory courses (Section 11.1.1).

11.2 SEMESTER END EXAMINATIONS

11.2.1 Theory Courses: 60 marks

The Semester end examinations shall be conducted for 3 hours duration at the end of the semester. The question paper shall be given in the following pattern: There shall be two questions from each unit with internal choice. Each question carries 15 marks. Each course shall consist of four units of the syllabus.

11.2.2 Lab Courses: 60 marks

40 marks are allotted for experiments/job works & **15** marks are allotted for viva-voce examination and **5** marks for the record.

11.2.3 Seminar: 60 marks

There shall be a seminar presentation. For Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, supervisor and two other senior faculty members of the department. For Seminar, the evaluation is done for 60 marks internally.

11.2.4 Self-Learning Courses: 60 marks

The semester end examinations for courses under this category are evaluated for 60 marks.

11.2.5 Project: 60 marks

The project (Project Part A and Part B) shall be evaluated for 60 marks in respective semesters. The semester end examination for project part - A shall be evaluated by HOD, Programme coordinator and one of the senior Professors of the Department.

Project part - B shall be evaluated by a project evaluation committee consisting of the Head of the Department, project internal guide and an external examiner approved by the Principal from a panel submitted by the HOD.

The rubrics for evaluation of semester end examination shall be defined by the Project review committee separately for Part - A and Part-B.

12. CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE

12.1 Conditions for Pass and award of Grades & Credits:

a) A candidate shall be declared to have passed in individual Theory course if he/she secures a minimum of 50% aggregate marks (continues evaluation & semester end examination marks put together), subject to a minimum of 40% marks in the semester end examination.

b) A candidate shall be declared to have passed in individual labs/ seminar/ course if he/she secures a minimum of 50% aggregate marks (continues evaluation & semester end examination marks put together), subject to a minimum of 50% marks in the semester end examination.

c) If a candidate secures minimum of 40% marks in Theory Courses in the semester end examination and 40% - 49% of the total marks in the semester end examination and continues evaluation taken together in some theory courses and secures an overall aggregate of 50% in all theory courses in that semester he/she declared to be passed in the theory courses of that semester in semester end Examinations. This provision is applicable for Regular candidates only during Regular Semester - end Examinations.

d) The student has to pass the failed course by appearing the examination when conducted subsequently, as per the requirement for the award of degree.

e) A candidate shall be declared to have passed the Project part A/ **P**roject part B, if he/she secures minimum of 50 % aggregate marks (continuous evaluation and semester end examination marks put together), subject to a minimum of 50 % of marks in semester end examinations.

f) If any candidate does not fulfill the pass requirement as per 12.1.(e) in semester end examination of Project Part - A, he / she will be given two months additional time to re appear at the semester end examination after paying the requisite examination fee and also the candidate has to bear the expenditure for conducting examination. If the candidate does not fulfill the pass requirement again in Project Part - A as per 12.1(e), he/she has to repeat the semester in next academic year.

g) In a special case, if any student does not submit his / her thesis of Project Part – B, due to ill health or any other genuine reason, he / she will be given another chance to appear at Project Part - B examination conducted separately at a later date i.e. within two months from the completion of Project Part - B semester end examination of that particular academic year after paying the requisite examination fee, if the expenditure for conducting Project Part - B is completely borne by the candidate.

h) On passing a course of a programme, the student shall earn assigned credits in that Course.

12.2 Method of Awarding Letter Grades and Grade Points for a Course.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table 8: Grading System for individual subjects/labs

Theory	Lab	Grade Points	Letter Grade
>= 90%	>= 90%	10	Ex
80-89%	80-89%	9	A+
70-79%	70-79%	8	A
60-69%	60-69%	7	B
50-59%	55-59%	6	C
45-49%	50-54%	5	D
40-44%	-	4	E
< 40%	< 50%	0	F (Fail)
ABSENT	ABSENT	0	AB

12.3 Calculation of Semester Grade Points Average (SGPA)* and award of division for the program.

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as below:

$$SGPA = \frac{\sum (CR \times GP)}{\sum CR}$$ (For all courses passed in semester)

Where CR= Credits of a course

GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the courses in that semester.

12.4 Calculation of Cumulative Grade Point Average (CGPA) for Entire Programme.

The CGPA is calculated as below:

$$CGPA = \frac{\sum (CR \times GP)}{\sum CR}$$ (For entire programme)

Where CR= Credits of a course

GP = Grade points awarded for a course

Table 9: Award of Divisions

CGPA	DIVISION
≥7.75	First Class with distinction
≥6.5 - <7.75	First Class
≥5.5 - <6.5	Second Class
≥4 - <5.5	Pass Class
<4	Fail

For the purpose of awarding first class with distinction, the candidate should complete the programme with in 2 years and should get required CGPA.

Detained, Break in study candidates, and the candidates who availed themselves of the opportunity of extension of project part – B for a further period of two months are not eligible for the award of first class with distinction.

For the purpose of awarding first/ second/ pass class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course including extensions in project, if any shall be considered.

12.5 Transitory Regulations

A candidate, who is detained or discontinued in the semester, on readmission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which have in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional subjects are to be studied as approved by Board of Studies and ratified by Academic Council.

12.6 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the two years M. Tech Programme.

13. READMISSION CRITERIA

A candidate, who is detained in a semester due to lack of attendance/marks, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of Rs. 1,000/-.

Rules for Calculation of Attendance for Re- Admitted students.

a) No.of classes conducted will be counted from the day 1 of the semester concerned, irrespective of the date of payment of tuition fee.

b) They should submit a written request to the principal of the college, along with a challan paid towards tuition and other fee. for re – admission before the commencement of class work.

c) Student should come to know about the date of commencement of class – work of the semester in to which he / she wishes to get re – admission. The information regarding date of commencement of class – work for each semester is available in the college notice boards / website.

14. BREAK IN STUDY

Student, who discontinues the studies for whatsoever may be the reason, can get readmission into an appropriate semester of M. Tech program after a break-in study only with the prior permission of the Principal of the College provided such candidate shall follow the transitory regulations applicable to such batch in which he/she joins. An administrative fee of Rs. 2000/- per each year of break in study in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

15. ELIGIBILITY FOR AWARD OF M.TECH. DEGREE

The M. Tech., Degree shall be conferred on a candidate who satisfies the following requirement. A student should register himself for 80 Credits, and should obtain all the 80 credits in order to become eligible for the award of M.Tech Degree.

16. CONDUCT AND DISCIPLINE

i. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.

ii. Willful damage or distribution of alcoholic drinks or any kind of narcotics to fellow students /citizens.

The following activities are not allowed within the campus

- Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institute.
- As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offense and is banned. Any form of ragging will be severely dealt with.
- The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.
- Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- Mutilation or unauthorized possession of library books.
- Noisy and unseemly behavior, disturbing studies of fellow students.
- Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cyber crime etc.
- Use of cell phones in the campus.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the college from time to time.
- Commensurate with the gravity of an offense, the punishment may be reprimanded, fine, expulsion from the institute / hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even

handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

- For an offense committed in (i) a hostel (ii) a department or in a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.
- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and Break-in-Study candidates are allowed into the campus for academic purposes only with permission from the authorities.
- Misconduct committed by a student outside the college campus, but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature & gravity of such misconduct.
- The Disciplinary Action Committee constituted by the Principal, shall be the authority to investigate the details of the offense, and recommend disciplinary action based on the nature and extent of the offense committed.
- "Grievance appeal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative /disciplinary matters.
- All the students must abide by the code and conduct rules of the college.

17. MALPRACTICES

- The Principal shall refer the cases of malpractices in internal assessment tests and Semester-End Examinations, to a Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of the candidate at an examination trying to get undue advantage in the performance or trying to help another, or derive the same

through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

18. OTHER MATTERS

18.1 The physically challenged candidates who have availed additional examination time and a scribe during their B. Tech/PGECET/GATE examinations will be given similar concessions on production of relevant proof/documents.

18.2 Students who are suffering from contagious diseases are not allowed to appear either internal or semester end examinations.

18.3 The students who participated in coaching/tournaments held at the state / National /International levels through University / Indian Olympic Association during the end semester external examination period will be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No.F.1-5/88(SPE/PES),dated18-08-1994.

18.4 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved in the Heads of the Departments Meetings, shall be reported to the academic council for ratification.

19. AMENDMENTS TO REGULATIONS

The Academic Council may, from time to time, revise, amend, or change the regulations, Schemes of examination and/or syllabi.

20. SCHEME OF INSTRUCTION

M.Tech Computer Science & Engineering Course Structure – M.TECH15

First Year – Semester I

S.No	Sub. Code	Subject Title	L	T	P	C	I	E	T
1	15CSCS1001	Data Structures and Algorithms	4	--	--	4	40	60	100
2	15CSCS1002	Advanced Data Mining	4	--	--	4	40	60	100
3	15CSCS1003	Internet Technologies	4	--	--	4	40	60	100
4	15CSCS1004	High Performance Computing	4	--	--	4	40	60	100
5	15CSCS1005	Self-Learning – MOOCs		--	--	2	40	60	100
6	15CSCS1006	Elective – I	4	--	--	4	40	60	100
7	15CSCS1051	Advanced Data Mining Lab	--	--	3	2	40	60	100
8	15CSCS1052	Internet Technologies Lab	--	--	3	2	40	60	100
9	15CSCS1053	High Performance Computing Lab	--	--	3	2	40	60	100
			20	**--**	**9**	**28**	**360**	**540**	**900**

L: Lecture **T**: Tutorial **P**: Practical **C**: Credits **I**: Internal Assessment **E**: End Semester **T**: Total Marks

SCHEME OF INSTRUCTION

M.Tech Computer Science & Engineering Course Structure – M.TECH15

First Year – Semester II

S.No	Sub. Code	Subject Title	L	T	P	C	I	E	T
1	15CSCS2001	Big Data Analytics	4	-	--	4	40	60	100
2	15CSCS2002	Internet of Things	4	-	--	4	40	60	100
3	15CSCS2003	Cloud Computing	4	--	--	4	40	60	100
4	15CSCS2004	Elective – II	4	--	--	4	40	60	100
5	15CSCS2005	Elective – III	4	--	--	4	40	60	100
6	15CSCS2051	Big Data Analytics Lab	--	--	3	2	40	60	100
7	15CSCS2052	Internet of Things Lab	--	--	3	2	40	60	100
8	15CSCS2053	Cloud Computing Lab	--	--	3	2	40	60	100
9	15CSCS2054	Seminar	--	--		2	40	60	100
			20	**--**	**9**	**28**	**360**	**540**	**900**

L: Lecture **T**: Tutorial **P**: Practical **C**: Credits **I**: Internal Assessment **E**: End Semester **T**: Total Marks

Second Year – Semester III

S.No	Sub. Code	Subject Title	L	T	P	C	I	E	T
1	15CSCS3051	Project Work - Part A				10	40	60	100
						10	**40**	**60**	**100**

Second Year – Semester IV

S.No	Sub. Code	Subject Title	L	T	P	C	I	E	T
1	15CSCS4051	Project Work - Part B				14	40	60	100
						14	**40**	**60**	**100**

MOOC 15CSCS1005
A – Human Computer Interaction B – Social Network Analysis C – R Programming D – Interactive Programming in Python E – Industry Need Based

Elective – 1 15CSCS1006
A – Bioinformatics B - Distributed Computing C – Machine Learning D – Software Architecture and Design E – Digital Image Processing F – Information Security G – Network Management H – Industry Need Based

Elective 2 15CSCS2004
A – Algorithms for Bioinformatics B – Grid Computing C – Pattern Recognition D – Software Project Management E – Computer Vision F – Cyber Security G – Ad hoc and Sensor Networks H – Industry Need Based

Elective – 3 15CSCS2005
A – Information Retrieval Systems B – Real Time Systems C – Natural Language Processing D – Software Reliability and Testing E – Biometrics F - Digital and Cyber Forensics G – Wireless and Mobile Networks H – Industry Need Based

VR Siddhartha Engineering College
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
M.Tech15 Curriculum - M.Tech. in Computer Science & Engineering
Effective from 2015-16 Academic Year

S. No	Sem–I	Sem–II	Sem–III	Sem-IV
1.	15CSCS1001	15CSCS2001	15CSCS3051	15CSCS4051
2.	15CSCS1002	15CSCS2002		
3.	15CSCS1003	15CSCS2003		
4.	15CSCS1004	15CSCS2004		
5.	15CSCS1005	15CSCS2005		
6.	15CSCS1006	15CSCS2051		
7.	15CSCS1051	15CSCS2052		
8.	15CSCS1052	15CSCS2053		
9.	15CSCS1053	15CSCS2054		

Programme Core (PC): 36 Credits

15CSCS1001	Data Structures and Algorithms
15CSCS1002	Advanced Data Mining
15CSCS1003	Internet Technologies
15CSCS1004	High Performance Computing
15CSCS2001	Big Data Analytics
15CSCS2002	Internet of Things
15CSCS2003	Cloud Computing

Lab Practice

15CSCS1051	Advanced Data Mining Lab
15CSCS1052	Internet Technologies Lab
15CSCS1053	High Performance Computing Lab
15CSCS2051	Big Data Analytics Lab
15CSCS2052	Network Simulation Lab
15CSCS2053	Cloud Computing Lab

Independent Learning – 4 credits

15CSCS1005	Self-Learning – MOOCs A – Human Computer Interaction B – Social Network Analysis C – R Programming D – Interactive Programming in Python E – Industry Need Based
15CSCS2054	Seminar

Project – 24 credits

15CSCS3051	Project Work – Part A
15CSCS4051	Project Work – Part B

Elective Courses – 12 Credits

Group 1	Software Engineering
15CSCS1006D	Software Architecture
15CSCS2004D	Software Project Management
15CSCS2005D	Software Reliability and Testing

Group 2	Security
15CSCS1006F	Information Security
15CSCS2004F	Cyber Security
15CSCS2005F	Digital and Cyber Forensics
15CSCS2005E	Biometrics

Group 3	Systems
15CSCS1006B	Distributed Computing
15CSCS2004B	Grid Computing
15CSCS2005B	Real Time Systems

Group 4	Network and Internet
15CSCS1006G	Network Management
15CSCS2004G	Ad hoc and Sensor Networks
15CSCS2005G	Wireless and Mobile Networks

Group 5	Soft Computing
15CSCS1006C	Machine Learning
15CSCS1006E	Digital Image Processing
15CSCS2004C	Pattern Recognition
15CSCS2004E	Computer Vision
15CSCS2005C	Natural Language Processing

Group 6	Open Group
15CSCS1006A	Bioinformatics
15CSCS2004A	Algorithms for Bioinformatics
15CSCS2005A	Information Retrieval Systems

15CSCS1001
DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Implement various tree operations.
CO2	Compare greedy and dynamic algorithms
CO3	Understand graph algorithms and their applications
CO4	Implement number theoretic algorithms.
CO5	Analyze string matching and Approximate algorithms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**3**		
CO2	**1**		**3**		
CO3	**1**	**2**		**1**	
CO4	**1**	**2**	**3**	**1**	
CO5		**2**	**3**		

COURSE CONTENT

UNIT I

Binary Search Trees: BST, Querying BST, Insertion and Deletion, Randomly built binary search trees.

Red-Black trees: Properties of Red-Black trees, Rotations, Insertion, Deletion.

B-Trees: Definition of B-trees, Basic operations on B-Trees, Deleting a key from a B-tree.

UNIT II

Dynamic Programming: Matrix Chain Multiplication, Elements of dynamic programming, longest common subsequences, optimal binary search trees.

Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes.

Amortized Analysis: Aggregate analysis, The Accounting method, Potential method, dynamic tables.

UNIT III

Single-Source Shortest Paths: Bellman-Ford Algorithm, Single-source shortest paths in directed acyclic graphs, Dijkstra's algorithm.

All-Pairs Shortest Paths: Floyd-Warshall algorithm.

String Matching: The naïve string-matching algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm.

UNIT IV

NP-Completeness: Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-complete problems

Approximate Algorithms: The vertex-cover problem, Travelling –salesman problem, Set-covering problem, Randomization and linear programming, subset-sum problem.

TEXT BOOKS

[1] Cormen, Leiserson, Rivest, and Stein, "Introduction to Algorithms", Third Edition , McGraw Hill, 2010.

REFERENCE BOOKS

1. Robert Sedgewick Philippe Flajolet, "An Introduction to the Analysis of Algorithms", First Edition, McGraw Hill, 1995.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd edition, Pearson Education.
3. Horowitz Sahni and Anderson-Freed," Fundamentals of Data Structures in C", 2nd edition, Universities Press.

15CSCS1002
ADVANCED DATA MINING

Course Category:		**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Analyze Algorithms for sequential patterns
CO2	Extract patterns from stream data
CO3	Apply Graph mining algorithms for Spatial data
CO4	Apply data analysis techniques on Multimedia, Text and Web data

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**		**1**	**1**	
CO2	**3**		**2**	**2**	
CO3	**3**		**2**	**2**	
CO4	**3**		**2**	**2**	

COURSE CONTENT

UNIT I

Mining Sequence Patterns in Transactional Databases: Sequential Pattern Mining: Concepts and Primitives, Scalable Methods for Mining Sequential Patterns, Constraint-Based Mining of Sequential Patterns, Periodicity Analysis for Time-Related Sequence Data.

Mining Sequence Patterns in Biological Data: Alignment of Biological Sequences, Hidden Markov Model for Biological Sequence Analysis: Markov chain, HideenMrkov model, Forward algorithm

UNIT II

Mining Data Streams: Methodologies for Stream Data Processing and Stream Data Systems, Stream OLAP and Stream Data Cubes, Frequent-Pattern Mining in Data Streams, Classification of Dynamic Data Streams, Clustering Evolving Data Streams.

Mining Time-Series Data: Trend Analysis, Similarity Search in Time-Series Analysis

UNIT III

Graph Mining: Methods for Mining Frequent Subgraphs, Mining Variant and Constrained Substructure Patterns, applications: Graph Indexing, Similarity Search, Classification, and Clustering

Spatial Data Mining: Spatial Data Cube Construction and Spatial OLAP, Mining Spatial Association and Co-location Patterns, Spatial Clustering Methods, Spatial Classification and Spatial Trend Analysis, Mining Raster Databases.

UNIT IV

Multimedia Data Mining: Similarity Search in Multimedia Data, Multidimensional Analysis of Multimedia Data, Classification and Prediction Analysis of Multimedia Data, Mining Associations in Multimedia Data, Audio and Video Data Mining

Text Mining: Text Data Analysis and Information Retrieval, Text Mining Approaches

Mining the World Wide Web: Mining the Web Page Layout Structure,

Mining the Web's Link Structures to Identify Authoritative Web Pages, Mining Multimedia Data on the Web.

TEXT BOOKS

[1] Jiawei Han Micheline Kamber, "*Data Mining Concepts and Techniques",* Morgan Kaufmann Publishers, Second edition,

REFERENCE BOOKS

[1] Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson, 2014

[2] G Dong and J Pei, "Sequence Data Mining", Springer, 2007;

[3] Charu C Aggarwal and Philip S Yu, Privacy – "Preserving Data Mining: Models and lgorithms", Springer, 2008

15CSCS1003
INTERNET TECHNOLOGIES

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand socket interface and client server models.
CO2	Know the functioning of application layer protocols.
CO3	Examine the architectures of electronic mail and world wide web.
CO4	Use multimedia protocols over internet.
CO5	Apply protocol analyzing and simulation tools to know the performance.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**		**2**		
CO2			**3**	**2**	
CO3			**2**		
CO4	**1**		**3**		
CO5			**2**	**2**	

COURSE CONTENT

UNIT I

The Client Server model and Software design: Introduction, Motivation, Terminology and concepts

The Socket Interface: Berkeley Sockets, The Socket Abstraction, A Generic Address Structure, Major System Calls Used With Sockets, Using Socket Calls In A Program

Algorithms and issues in client software design: Client architecture, Using TCP for client server connections, Using UDP for client server connections

Algorithms and issues in server software design: The conceptual server algorithm, Concurrent vs iterative servers, Four basic types of servers, Iterative server algorithms, Concurrent server algorithms

UNIT II

Next Generation IPv6 : IPV6 address space allocation, packet format, ICMPV6, Transition from IPV4 to IPV6.

DHCP: DHCP operation, configuration

Domain name system: Name Space, Distribution of name space, DNS in internet, Resolution, DNS massages, Types of records

Remote Login: TELNET and SSH: Concepts, Network Virtual Terminal (NVT), Secure shell (SSH).

UNIT III

FTP and TFTP: Connections, Communication, Command processing, File transfer, User interface, TFTP.

Electronic mail: SMTP, POP, IMAP: Architecture, User agents, Mail transfer agent:SMTP, Message access agent:POP and IMAP, Web-based email.

World Wide Web – HTTP: Architecture, Web Documents, HTTP Transaction, Request & Response messages, Cookies, Proxy Servers

UNIT IV

Multimedia in Internet

Streaming stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, Real-Time Transport Protocol (RTP), Real-time TransportControl Protocol (RTCP), Voice over IP (VoIP), Session Initiation Protocol(SIP)

Protocol analyzing and Simulation tools

Tcpdump, Wire-shark, ethereal, Study of Network Simulator 2 (NS-2) - installation,configuration, Network simulator(NS2) preliminaries, working with trace files, Examplescripts.

TEXT BOOKS

1. Douglas E. Comer, David L. Stevens ,"Internetworking with TCP/IP Vol. III, Client-Server Programming and Applications", Addison-Wesley, 2 nd edition,2010
2. Behrouz A. Forouzan, "TCP/IP Protocol suite", 4th Edition, Tata McGraw Hill 2010

REFERENCE BOOKS

1. W.Richard Stevens, UNIX Network Programming, Sockets API, Volume I, 3rd Edition, PHI , 2010

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://www.tcpdump.org/tcpdump_man.html(Accessed on 16 February 2016)
2. https://wiki.wireshark.org/CaptureSetup(Accessed on 16 February 2016)
3. http://www.isi.edu/nsnam/ns/(Accessed on 16 February 2016)

15CSCS1004
HIGH PERFORMANCE COMPUTING

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Analyze the parallel programming platforms for parallel computer systems.
CO2	Optimize the performance of parallel programs.
CO3	Analyze the working group communication operations of MPI, OpenMP, threads.
CO4	Implement algorithms for Matrix, Sorting and Graphs using MPI Library.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**3**	**2**	
CO2			**3**		
CO3	**1**		**3**	**2**	
CO4	**1**		**3**	**2**	

COURSE CONTENT

UNIT I

Parallel Programming Platforms: Implicit parallelism: Trends in Microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication costs in parallel machines, Routing mechanisms for interconnection networks.

Principles of Parallel Algorithm Design: Preliminaries, decomposition Techniques, Characteristics of tasks and interactions, mapping techniques for load balancing, methods for reducing interaction overheads, parallel algorithm models

UNIT II

Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, circular shift, Improving the speed of some communication operations.

Analytical modeling of parallel programs: sources of overhead in parallel programs, performance metrics for parallel systems, The Effect of granularity on performance, scalability of parallel systems, minimum execution time and minimum cost optimal execution time, asymptotic analysis of parallel programs.

UNIT III

Programming using the message passing paradigm: Principles of Message passing programming, The building blocks: Send and Receive Operations, MPI: the message passing interface, Topologies and embedding, Overlapping communication with computation, collective communication and computation Operations, Groups and communicators.

Programming shared address space platforms: Thread Basics, why Threads, The POSIX thread API, Thread Basics: Creation and Termination, Synchronization primitives in Pthreads, Controlling Thread and Synchronization Attributes, Composite synchronization constructs, OpenMP: a standard for Directive based Parallel Programming.

UNIT IV

Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix – Matrix Multiplication, Solving a system of linear Equations.

Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble sort and its variants, Quick sort.

Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source shortest paths: Dijkstra's Algorithm, All-pair shortest paths, Transitive Closure

TEXT BOOKS

[1] Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar: Introduction to Parallel Computing, Second Edition Pearson Education, 2007.

REFERENCE BOOKS

[1] Michael J. Quinn, Parallel Programming in C with MPI and OpenMP McGraw-Hill International Editions, Computer Science Series, 2004.

MOOCS
15CSCS1005A
HUMAN COMPUTER INTERACTION

Course Category:	Self-Learning Course	**Lecture-Tutorial-Practice:**	2-0-0
Course Type:	Online	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the concepts of Screen design and Graphical User Interface
CO2	Understand human interaction characteristics in the design process.
CO3	Discover and Use screen elements for presenting information simply and effectively.
CO4	Analyze device based, screen based controls and components of a window.
CO5	Create user interface design using various software tools.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1			**1**		
CO2	**2**		**1**		**1**
CO3	**2**			**2**	
CO4					**1**
CO5			**3**	**2**	**2**

COURSE CONTENT

UNIT 1

Introduction: Importance of user interface, definition, importance of good design, A brief history of Screen Design

Graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical system, characteristics,

Web user Interface: popularity, characteristics- principles of user interface.

UNIT II

Design Process: Human interaction with computers, importance of human characteristics, human considerations, human interaction speeds

Screen designing: Interface design goals, screen meaning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis, presenting information simply and meaningfully, technological considerations in interface design.

UNIT III

Windows: Characteristics, components, operations. Selection of device based and screen based controls.

Components: Icons and images, Multimedia, choosing proper colors.

UNIT – IV

Software Tools: Specification methods, interface, Building tools

Interaction devices: Keyboard and function keys, pointing devices, speech recognition, digitization and generation, image and video displays, drivers.

TEXT BOOKS

[1] Wilbert O Galitz, The Essential Guide to User Interface Design. 2nd edition, Wiley DreamaTech

[2] Ben Shneidermann, Designing the User Interface. 3rd edition, Pearson Education Asia.

REFERENCE BOOKS

[1] Alan Dix, Janet Fincay, Gre Goryd, Abowd and Russell Bealg, Human Computer Interaction,2nd edition Pearson Education.

[2] Prece, Rogers, Sharps Interaction Design. Wiley Dreamatech Soren Lauesen, User Interface Design, 2nd edition Pearson Education.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Interaction Design Specialization By Prof. Scott Klemmer from University of California, San Diego in www.coursera.org.
URL:https://www.coursera.org/course/hciucsd,
https://class.coursera.org/hci/lecture
Accessed on 12/19/2015 Course Schedule (coursera): Self paced learning

[2] Human Computer Interaction by Prof. Alan Dix, University of Birmingham , Scotland URL : http://hcicourse.com/ Accessed on 12/19/2015 Course Schedule (hcicourse): 4 Weeks

[3] Interaction Design Foundation by Prof. Alan Dix, University of Birmingham , Scotland
URL:https://www.interaction-design.org/courses/human-computer_interaction.html. Accessed on 12/19/2015

MOOCS
15CSCS1005B
SOCIAL NETWORK ANALYSIS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of social networks
CO2	Analyze the Structural properties of networks
CO3	Understand the Cascading properties of networks
CO4	Use Graph mining for linkage analysis on web

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**3**				
CO2	**1**				
CO3			**3**	**1**	
CO4			**2**	**2**	

COURSE CONTENT

UNIT I

Introduction: Motivation, different sources of network data, types of networks, tools for visualizing network data, review of graph theory basics.

UNIT II

Structural properties of networks: Notions of centrality, cohesiveness of subgroups, roles and positions, structural equivalence, equitable partitions, stochastic block models.

UNIT III

Cascading properties of networks: Information influence diffusion on networks, maximizing influence spread, power law and heavy tail distributions, preferential attachment models, small world phenomenon.

UNIT IV

Mining Graphs: Community and cluster detection: random walks, spectral methods; link analysis for web mining.

TEXT BOOKS

[1] Stanley Wasserman, Katherine Faust, "Social network analysis methods and applications" Cambridge University Press, 1994.

[2] David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.

REFERENCE BOOKS

[1] Peter R. Monge, Noshir S. Contractor, "Theories of communication networks", Oxford University Press, 2003.

[2] Duncan Watts," Six degrees: the science of a connected age", Norton, 2004

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Stanford Online material, (Accessed on 16 February 2016) http://scpd.stanford.edu/search/publicCourseSearchDetails.do?method=load&courseId=7932016

[2] Stanford Online material, http://web.stanford.edu/class/cs224w/ (Accessed on 16 February 2016)

[3] International Network for Social Network Analysis (INSNA) home page http://www.heinz.cmu.edu/project/INSNA/ (Accessed on 16 February 2016)

RELATED COURSES OFFERED ONLINE:

1. Lada Adamic, Adjunct Associate Professor, School of Information, Center for the Study of Complex Systems, University of Michigan in www.coursera.com (Accessed on 16 February 2016)
   URL: https://www.coursera.org/course/sna
2. Introduction to Social Network Analysis taught by Dr. Jennifer Golbeck (Accessed on 16 February 2016)
   URL: http://www.statistics.com/social-network-analysis

MOOCS
15CSCS1005C
R PROGRAMMING

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic concepts of R
CO2	Use the R data types
CO3	Analyze functions in R and identify set of functions for a given problem.
CO4	Implement visual exploratory graphics for importing data.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1				**3**	
CO2			**2**	**3**	
CO3	**3**		**1**	**2**	
CO4		**3**	**1**	**2**	

COURSE CONTENT

UNIT I

Introduction to R: Basic Concepts of R, R features, introduction to the main data types and visualization, Obtaining R, Objects - types of objects, classes, creating and accessing objects, Arithmetic and matrix operations.

Introduction to R libraries, R packages, Managing R session, Reading and

writing data

UNIT II

Control structures, scoping rules, Loop functions, relational and logical operations; flow control, the if statement looping: for, repeat, while. writing functions, function arguments and options.
Introduction to Matrices, Vectors, functions, lists and data frames.

UNIT III

Working with Data, Saving, Loading, and Editing Data, Importing Data from External Files, Importing Data from Databases, Exporting Data, Preparing Data. Introduction to graphics.

UNIT IV

Doing Maths in R, Dates and times, statistical models in R, Tools for accessing files on the Internet. Biological sequences, Matching patterns. Package basics, Package Management and authoring, Initialization, Debugging and Profiling.

TEXT BOOKS

1. Richard Cotton "R Paperback" O'Reilly,Paperback, 26 Sep 2013 .
2. Joseph Adler, "R in a Nutshell: A Desktop Quick Reference" O'Reilly Paperback – January 14, 2010.

REFERENCE BOOKS

1. Garrett Grolemund "Hands-On Programming with R: Write Your Own Functions and Simulations " O'Reilly; First edition 2014.
2. Özgür Ergül "Guide to Programming and Algorithms Using R", Springer-Verlag London, 2013.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://tryr.codeschool.com/levels/1/challenges/1 (Accessed on 10th July 2016)
2. http://www.computerworld.com/article/2497464/business-intelligence/business- intelligence-60-r-resources-to- improve-your-data-

skills.html (Accessed on 10th July 2016)

3. https://www.datacamp.com/courses/intermediate-r (Accessed on 10th July 2016)
4. http://heather.cs.ucdavis.edu/~matloff/r.html (Accessed on 10th July 2016)
5. http://www.inside-r.org/r-doc/base (Accessed on 10th July 2016)

RELATED COURSES OFFERED ONLINE:

1. **R Programming Roger D. Peng, PhD Johns Hopkins University**
   https://www.coursera.org/course/rprog,
   August 3-August 30 2015
2. **Explore Statistics with R , Free online courses from KIx: Karolinska Institutet,**
   https://www.edx.org/course/explore-statistics-r-kix-kiexplorx-0,
   Starts Self-Paced
3. **A course by Filip Schouwenaars**
   https://www.datacamp.com/courses/free-introduction-to-r,
   Starts Self-Paced
4. **A course by Filip Schouwenaars**
   https://www.datacamp.com/courses/intermediate-r,
   Starts Self-Paced

MOOCS
15CSCS1005D
INTERACTIVE PROGRAMMING IN PYTHON

Course Category:	MOOCS	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand python lexical features and syntax.
CO2	Learn the concepts of Object oriented programming with python.
CO3	Create Modules and Packages.
CO4	Create GUI and WUI in Python.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**2**				
CO2				**3**	**2**
CO3				**3**	**2**
CO4				**3**	**2**

COURSE CONTENT

UNIT I

Introduction to Python:

Python introduction, Python's Integrated Development Environment, Lexical Conventions and Syntax , Program Structure, variables, Data types, Expressions, Statements, Functions, Conditionals and Recursion, Iterations,

Strings. Lists and Tuples.

UNIT II

Object Oriented programming:

Classes and Objects, object representation, constructors, attributes, encapsulation, attribute binding, inheritance, extending a class through inheritance, and Polymorphism, memory management.

Files and Directories :

File Objects, Writing and Reading Text Files, Renaming, moving, copying and removing files, File Exceptions, Paths and Directories.

UNIT III

Modules and Packages:

Bringing Everything into the Current Scope, Exploring built-in Modules, Writing Modules and Packages, Re-importing Modules and Packages.

Lists and dictionaries: using Lists, list methods, understanding when to use tuples and lists, nested sequences, shared references, dictionaries, hangman game. Functions, creating functions, parameters and return values, keyword arguments, default parameters, global variables.

UNIT IV

GUI with Python: GUI programming toolkits for python , Tkinter introduction , creating GUI widgets with Tkinter, resizing the widget, configuring widget options ,putting the widgets to work, creating layouts , packing order , controlling widget appearances , radio buttons and checkboxes, dialog boxes , other widget types.

WUI with Python: Web Programming with python, Django python framework, CGI and Its Drawbacks, Mod_Python, Dynamic web site with mod_python

TEXT BOOKS

1. Allen B.Downey, "Think Python" , 3rd Edition, Oreilly Publications , 2015
2. James Payne , "Beginning Python: Using Python 2.6 & Python 3.1" , Wiley India, 2011.

REFERENCE BOOKS

1. Barry & Griffiths,"Head First Programming: A Learner's Guide to Programming using Python Language " , Shroff/O'Reilly Publications, 2015.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://learnpythonthehardway.org/book/. Created on 21 Oct, 2013. (Accessed on 10th July 2016)
2. The Python Tutorial available at http://docs.python.org/3.3/tutorial/ (Accessed on 10th July 2016)

RELATED COURSES OFFERED ONLINE:

[1]**Python Programming for Everybody(Python) By Zachary Dodds, Professor , Harvey Mudd College, USA**
URL: https://www.edx.org/course/ **Course Schedule :** 9 Weeks

[2]**Introduction to Computer Science and Programming Using Python by Prof. Eric Grimson et all, Massachusetts Institute of Technology(MIT) in www.edx.org**
URL: https://www.edx.org/course/introduction-computer-science-mitx-6-00-1x-0. **Course Schedule**: 4 Weeks

[3]**Programming for Everybody(Python) By Prof. Charles Severance, University of Michigan in www.coursera.com**
URL: https://www.coursera.org/course/pythonlearn.
Course Schedule (coursera): 4 Weeks

[4]**Learn Python Programming from Scratch in www.udemy.com**
URL: https://www.udemy.com/learn-python-programming-from-scratch/.
Course Schedule (udemy): Always on

[5]**Learn to Program Using Python by Prof. Farhad Kamangar by University of Texas Arlington, UsA in** www.edx.org.
URL:https://www.edx.org/course/learn-program-using-python-utarlingtonx-cse1309x. Course Schedule: Self paced.

15CSCS1006A
BIOINFORMATICS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Know the biological sequence and structural databases.
CO2	Understand the genome information and DNA sequence analysis
CO3	Describe pair-wise and multiple sequence alignment methods
CO4	Analyze secondary structure DNA data.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**3**		**1**		
CO2	**3**		**1**	**2**	
CO3	**3**		**1**	**2**	
CO4	**3**	**1**	**1**		

COURSE CONTENT

UNIT I

Introduction: Definitions, Sequencing, Biological sequence/structure, Genome Projects, Pattern recognition an prediction, Folding problem, Sequence Analysis, Homology and Analogy.

Protein Information Resources: Biological databases, Primary sequence

databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases

UNIT II

Genome Information Resources: DNA sequence databases, specialized genomic resources

DNA Sequence analysis: Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases

UNIT III

Pair wise alignment techniques: Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, sub-sequences, Identity and similarity, The Dot plot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

Multiple sequence alignment: Definition and Goal, The consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching.

UNIT IV

Secondary database searching: Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

Analysis packages: Analysis package structure, commercial databases, commercial software, comprehensive packages, packages specializing in DNA analysis, Intranet Packages, Internet Packages.

TEXT BOOKS

1. T K Attwood & D J Parry-Smith, Introduction to Bioinformatics, Addison Wesley Longman.
2. Bioinformatics –A Beginners Guide by Jean-Michel Claveriw, CerdricNotredame, WEILEY dreamtech India Pvt. Ltd.

REFERENCE BOOKS

1. Sequence Analysis in A Nutshell, Scott Markel &Darryl Leon, O'REILLY

15CSCS1006B
DISTRIBUTED COMPUTING

Course Category:	Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand models of distributed computing.
CO2	Analyse issues of distributed systems.
CO3	Analyse distributed algorithms for deadlocks and mutual exclusion.
CO4	Analyse rollback and recovery in distributed system.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**		**2**	**2**	
CO2	**1**		**3**	**3**	
CO3	**2**		**3**	**3**	
CO4	**2**		**3**	**3**	

COURSE CONTENT

UNIT I

Distributed Computing Introduction: Relation to computer system components, relation to parallel multiprocessor/multicomputer systems, synchronous versus asynchronous execution, design issues and challenges.

A Model of Distributed Computations: A Model of distributed executions,

Models of communication networks, Global state of a distributed system, Models of process communication.

Logical Time: A framework for a system of Logical clocks, scalar time, vector time, efficient implementation of vector clocks, Jard-Jourdan's adaptive technique, Matrix time, virtual time, Physical clock synchronization: NTP.

UNIT II

Global state and snapshot recording algorithms: System model, Snapshot algorithms for FIFO channels, Variations of Chandy-Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, Monitoring global state, Nececssary and sufficient conditions for consistent global snapshots, finding consistent global snapshots in a distributed computation.

Message ordering and group communication: Mesage ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order, A nomenclature for multicast, Propagation trees for multicast, Classification of application-level multicast algorithms, Semantics of fault-tolerant group communication, Distributed multicast algorithms at the network layer.

UNIT III

Termination detection: System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, A spanning- tree-based termination detection algorithm, Message-optimal termination detection, Termination detection in a very general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system.

Distributed mutual exclusion algorithms: Preliminaries, Lamport's algorithm, Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms.

Deadlock detection in distributed systems: System model, Preliminaries, Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the single resource model,

Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra– Haas algorithm for the OR model.

UNIT IV

Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory mutual exclusion, Wait-freedom.

Check pointing and rollback recovery: Issues in failure recovery, Checkpoint based recovery, Log-based rollback recovery, Koo–Toueg coordinated checkpointing algorithm, Juang–Venkatesan algorithm for asynchronous checkpointing and recovery, Manivannan–Singhal quasi-synchronous checkpointing algorithm.

Authentication in distributed systems: Protocols based on symmetric cryptosystems, Protocols based on asymmetric cryptosystems, Password-based authentication, Authentication protocol failures.

TEXT BOOKS

1. Ajay D. Kshemakalyani, Mukesh Singhal, "Distributed Computing",Cambridge University Press, 2008.

REFERENCE BOOKS

2. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", Prentice Hall India, 2004

15CSCS1006C
MACHINE LEARNING

Course Category:	Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand a wide variety of learning algorithms.
CO2	Understand how to evaluate models generated from data.
CO3	Apply the algorithms to a real problem.
CO4	Analyze various learning techniques of Machine Learning.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**2**		**2**	**1**	
CO2	**1**		**1**	**1**	
CO3	**2**		**2**	**2**	
CO4	**2**		**2**	**2**	

COURSE CONTENT

UNIT I

Introduction - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning.

Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a

maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias .

UNIT II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

UNIT III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm **Computational learning theory –** Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning - Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution **Analytical Learning -** Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

TEXT BOOKS

1. Tom M. Mitchell, "Machine Learning", McGraw Hill, 1997.
2. Stephen Marsland, Taylor & Francis, "Machine Learning: An Algorithmic Perspective", 2nd Edition, 2014.

REFERENCE BOOKS

1. William W Hsieh, "Machine Learning Methods in the Environmental Sciences, Neural Networks and kernels" Cambridge Univ Press, 1st Edition.
2. Richard o. Duda, Peter E. Hart and David G. Stork, "pattern classification", John Wiley & Sons Inc, 2nd Edition.
3. Chris Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, 1995.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://nptel.ac.in/courses/110106064/16 (Accessed on 05/03/2016)

15CSCS1006D
SOFTWARE ARCHITECTURE AND DESIGN

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the key elements of software architecture
CO2	Analyze different Software architectural styles and apply to develop a system.
CO3	Study working knowledge of software architecture design for an application system.
CO4	Recognize how software architecture helps different software lifecycle stages.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**			**2**	
CO2	**1**		**2**	**2**	
CO3	**1**		**2**	**2**	
CO4	**1**		**2**	**2**	

COURSE CONTENT

UNIT I

Introduction to Software Architecture

What Is Software Architecture: What Software Architecture Is and What It Isn't, Architectural Structures and Views, Architectural Patterns, What Makes a "Good" Architecture?

The Many Contexts of Software Architecture: Architecture in a Technical Context, Architecture in a Project Life-CycleContext, Architecture in a Business Context, Architecture in a Professional Context Stakeholders, How Is Architecture Influenced, What Do Architectures Influence?

UNIT II

Quality Attributes Understanding Quality Attributes: Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality AttributeRequirements, Achieving Quality Attributes throughTactics, Guiding Quality Design Decisions, Availability, Interoperability, Modifiability, Performance, Security, Testability, Usability, Other Quality Attributes

UNIT III

Architectural Tactics and Patterns: Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics andPatterns, Using Tactics Together

Quality Attribute Modeling and Analysis: Modeling Architectures to Enable QualityAttribute Analysis, Quality Attribute Checklists, Thought Experiments and Back-of-the-Envelope Analysis Experiments, Simulations, and Prototypes, Analysis at Different Stages of the Life Cycle.

UNIT IV

Architecture in the Life Cycle: Architecture in Agile Projects: How Much Architecture? Agility and Architecture Methods, A Brief Example of Agile Architecting, Guidelines for the Agile Architect.

Architecture and Requirements: Gathering ASRs from RequirementsDocuments, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding theBusiness Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together

Designing an Architecture: Design Strategy, The Attribute-Driven Design Method, The Steps of ADD

TEXT BOOKS

1. Len Bass, Paul Clements, Rick Kazman "Software Architecture in Practice"

SEI Series in Software Engineering Addison-Wesley Professional; 3 edition, 2012.

2. Kai Qian , Xiang Fu , Lixin Tao , Chong-wei Xu "Software Architecture And Design Illuminated ,Jones and Bartlett Illuminated, Jones & Bartlett Learning; 1 edition, 2009.

REFERENCE BOOKS

1. Paul Clements, Felix Bachmann, Len Bass, David Garlen, James Ivers, Reed Little, Robert Nord, Judith Stafford "Documenting Software Architectures: Views and Beyond" Second Edition, 2010.

E-RESOURCES AND OTHER DIGITAL MATERIAL

2. Software Architecture and Design (Web) by Prof.T.V.Prabhakar , IIT Kanpur, 2015

15CSCS1006E
DIGITAL IMAGE PROCESSING

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts and basic relations among the pixels.
CO2	Analyse the Spatial and Frequency domain concepts for image enhancement.
CO3	Identify the image restoration filter for degraded image.
CO4	Understand the image segmentation techniques and wavelet transforms.
CO5	Compare the lossy and lossless image compression techniques.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**3**		**3**	**3**	
CO2	**3**		**3**	**3**	
CO3	**3**		**3**	**3**	
CO4	**3**		**3**	**3**	
CO5	**3**		**3**	**3**	

COURSE CONTENT

UNIT I

Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System

Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels

UNIT II

Intensity transformations: Some Basic intensity Transformation functions, Histogram Processing, Smoothing and Sharpening.

Spatial and Frequency Filtering for Image Enhancement: Fundamentals of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters, Fundamentals of Frequency Filtering, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters

UNIT III

Image restoration: A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering

Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Color Image Processing**:** Color fundamentals, color models, pseudo color image processing, basics of full – color image processing

UNIT IV

Image Compression: Fundamentals, image compression models, lossy predictive coding, lossless compression, image compression standard-JPEG.

Wavelet Transformation: Background, image pyramids, 1-D wavelet transforms 2-D wavelet Transform, Fastest wavelet transforms.

TEXT BOOKS

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. 3ed, PHI/Pearson Education, 2007

REFERENCE BOOKS

1. S. Jayaraman, S. Esakkirajan And T.Veerakumar , "Digital Image Processing" 3Ed, Tata McGraw - Hill Education Pvt. Ltd, 2010.
2. A.K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall India, 2000

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. Lecture Series on Digital Image Processing by Prof. P.K.Biswas, IIT Khargapur Available at: http://nptel.ac.in/courses/117105079/1

15CSCS1006F
INFORMATION SECURITY

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Identify security vulnerabilities of cryptosystems.
CO2	Analyze methods of symmetric and Asymmetric key cryptography
CO3	Understand techniques for data hiding and watermarking
CO4	Apply data hiding techniques into different domains

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**3**		**2**		
CO2	**2**		**3**		
CO3	**3**		**3**		
CO4	**2**		**2**		

COURSE CONTENT

UNIT I

Security attacks, A model for network security; **Classical techniques:** Encryption, Steganography; **Modern techniques:** simple DES, Block cipher principles, Differential and linear cryptanalysis; DES, AES; Characteristics of Advanced Symmetric block ciphers

UNIT II

Conventional Encryption: Placement of Encryption function, Traffic confidentiality, key distribution, Random number generation. **Number Theory:** Prime and relative prime numbers, modular arithmetic: theorems, testing for primality, Euclid's algorithm, Chinese remainder theorem, discrete logarithms. **Public key cryptography:** principles, RSA algorithm, key management, Diffie-Hellman key exchange, Elliptic curve cryptography.

UNIT III

Message Authentication and Hash functions: Authentication requirements and functions, security of hash functions and MACs. Message digest algorithm, secure hash algorithm. Digital signatures and standards. Introduction: data hiding models, security and privacy aspects, techniques for hiding data-Digital audio, video, images and text

UNIT IV

Steganography: Introduction, how it is different from cryptography, Classification of steganography algorithms: Transform-based, spatial domain, statistical, Applications of steganography: Covert channels, audio data, military, e-commerce. **Watermarking:** Introduction, how it is different from steganography and cryptography, watermarking algorithms, watermarking applications, limitations in watermarking.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 5th Ed,PearsonEducation, 2013
2. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann, 2nd Edition, 2007.

REFERENCE BOOKS

1. Niels Ferguson, Bruce Schneier, Tadayoshi Kohno, "Cryptography Engineering: Design Principles and Practical Applications", Wiley publication, 2010
2. Atul Kahate, "cryptography and Network Seurity", TATA Mc GrawHill, 2nd Edition.

15CSCS1006G
NETWORK MANAGEMENT

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand networking standards, policies, procedures and services.
CO2	Analyze different Networks and Models.
CO3	Discriminate M1, M2 and M3 interfaces.
CO4	Apply the basic Network management Application.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**2**				
CO2		**2**	**1**		
CO3			**1**		
CO4				**2**	

COURSE CONTENT

UNIT I

Analogy of Telephone Network Management, Data and Telecommunication, Network Distributed computing Environments, TCP/IP Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication

Architectures, Protocol Layers and Services, Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance, Network and System Management, Network Management System platform, Current Status and Future of Network Management.

UNIT II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model, Functional Model.

SNMPv1 Network Management: Managed Network, History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview, Information Model, The Structure of Management Information, Managed Objects, Management Information Base.

UNIT III

Broadband Network Management ATM Networks: Broadband Networks and Services, ATM Technology, Virtual Path-Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model ,The Integrated Local Management Interface, The ATM Management Information Base ,The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface Customer Network Management of Public Networks, M4 Interface: Public

Network Management, Management of LAN Emulation, ATM Digital Exchange Interface Management.

UNIT IV

Network Management Applications Configuration Management- Network Provisioning, Inventory Management Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques Performance Management – Performance Metrics, Data Monitoring Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

TEXT BOOKS

1. Mani Subramanian,"Network Management- Principles and Practice", 2nd Pearson Education, 2003.

REFERENCE BOOKS

1. J. Richard Burke, "Network management Concepts and Practices: a Hands-On Approach", PHI, 2008.

15CSCS1051
ADVANCED DATA MINING LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	0-0-3
Course Type:	Lab	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyze Algorithms for sequential patterns
CO2	Extract patterns from stream data
CO3	Apply Graph mining algorithms for Spatial data
CO4	Apply data analysis techniques on Multimedia, Text and Web data

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**		**1**	**1**	
CO2	**3**		**2**	**2**	
CO3	**3**		**2**	**2**	
CO4	**3**		**2**	**2**	

LIST OF LAB TASKS

Task 1: Sequential Pattern Mining

Task 2: Constraint-Based Mining

Task 3: Alignment of Biological Sequences

Task 4: Stream OLAP

Task 5: Similarity Search in Time-Series Analysis

Task 6: Mining Substructure Patterns: Graph mining basing on classification

Task 7: Mining Substructure Patterns: Graph mining basing on clustering

Task 8: Data analysis on spatial data

Task 9: Text categorization

Task 10: Web data mining

15CSCS1052
INTERNET TECHNOLOGIES LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	0-0-3
Course Type:	Lab	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand socket interface and client server models.
CO2	Know the functioning of application layer protocols.
CO3	Examine the architectures of electronic mail and world wide web.
CO4	Use multimedia protocols over internet.
CO5	Apply protocol analyzing and simulation tools to know the performance.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**		**2**		
CO2			**3**	**2**	
CO3			**2**		
CO4	**1**		**3**		
CO5			**2**	**2**	

LIST OF LAB TASKS

Task 1: Client program using UDP to connect to well known services (echo, time of the day service etc.).

Task 2: Implementing concurrent TCP multiservice client/server.

Task 3: Implementing Iterative UDP client/server.

Task 4: Write a program to implement echo server using IPv6 socket.

Task 5: Study of following DNS Tools with all its options. nslookup, dig, host, whois

Task 6: Implement trivial file transfer protocol (TFTP).

Task 7: Write program to send a mail using SMTP commands and receive a mail using POP3 commands.

Task 8: Developing Personal Website with database connectivity.

Task 9: Capturing & Analyzing operation of various application layer protocols using network protocol analyzer. (Wireshark and tcpdump)

Task 10: Installation, configuration of NS-2 and Simulation of simple protocols using NS-2 Scripts

Task 11: Study of various streaming multimedia protocols in Internet (Using various audio/video streaming services on the Internet)

15CSCS1053
HIGH PERFORMANCE COMPUTING LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	0-0-3
Course Type:	Lab	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyze the parallel programming platforms for parallel computer systems.
CO2	Optimize the performance of parallel programs.
CO3	Analyze the working group communication operations of MPI, OpenMP, threads.
CO4	Implement algorithms for Matrix, Sorting and Graphs using MPI Library.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**3**	**2**	
CO2			**3**		
CO3	**1**		**3**	**2**	
CO4	**1**		**3**	**2**	

LIST OF LAB TASKS

Task 1: Implement Basic of MPI Programs.

Task 2 Write a Program for Communication between MPI processes.

Task 3: Implement advance communication between MPI processes

Task 4: Implement MPI collective operations using ‘Synchronization’

Task 5: Implement MPI collective operations using ‘Data Movement’

Task 6: Implement MPI collective operations using ‘Collective Computation’

Task 7: Write a program for MPI Non-Blocking operation

Task 8: Implement Matrix-Matrix multiplication - Cannon’s, DNS algorithm.

Task9: Implement Sorting – Shell sort, Quick sort, Bucket.

Task10: Implement Minimum spanning tree.

Task11: Implement Single source shortest paths.

Task12: Implement All-pairs shortest paths – Dijkstra’s algorithm, Floyd’s algorithm

Task13: Implement Transitive closure.

Task14: Implement Connected components.

SEMESTER II

15CSCS2001
BIG DATA ANALYTICS

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of Big Data Analytics
CO2	Apply machine learning algorithms for Big Data Analytics
CO3	Apply text categorization algorithms
CO4	Solve the Big Data Analytics problems using various technologies and tools

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**2**	**2**	
CO2	**2**			**2**	
CO3	**2**			**2**	
CO4	**2**			**2**	

COURSE CONTENT

UNIT I

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics

Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Discovery,

Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

Mathematics for Data Analytics: Variance and Standard Deviation, Covariance and Correlation,Distributions Derived From the Normal Distribution-Introduction, Chi-Squared, t, and F Distributions

UNIT II

Advanced Analytical Theory and Methods-Clustering: k-means, additional algorithms;

Association Rules: Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Transactions in a Grocery Store, Validation and Testing;

Regression: Linear Regression, Logistic Regression, Additional Regression Models

UNIT III

Advanced Analytical Theory and Methods-Classification: Decision Trees, Naïve Bayes;

Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model;

Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments

UNIT IV

Hadoop: MapReduce -A Weather Dataset, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Distributed File system-The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystem; Developing a MapReduce Application- Writing a unit with test MRUnit, running locally on test data; How Map reduce works- Anatomy of a MapReduce Job Run;

The Hadoop Ecosystem-Pig, Hive, HBase, NoSQL, Sqoop-getting Sqoop, Sqoop Connectors, A sample Import, Generated code; Spark-Spark Applications .jobs, stages and tasks, Anatomy of a Spark job run.

TEXT BOOKS

[1] Data Science and Big Data Analytics, EMC^2 Education Services, wiley, 2015

[2] John A. Rice**,** Mathematical Statistics and Data Analysis, 3rd Edition, Cengage

[3] Tom White,Hadoop: The Definitive Guide, 4rd Edition, O'reilly Publication, 2015

REFERENCE BOOKS

[1] VigneshPrajapati, Big Data Analytics with R and Hadoop, packet publishing, 2013Bill

[2] Franks, Taming, The Big Data Tidal Wave, 1st Edition, Wiley, 2012.

[3] Frank J. Ohlhorst, Big Data Analytics,1st Edition, Wiley, 2012.

15CSCS2002

IoT: INTERNET OF THINGS

Course Category:	Institutional Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the IoT Architecture and its major components.
CO2	Analyze the appropriate Microcontroller Architecture for an IoT Application.
CO3	Develop IoT Application using IoT platforms.
CO4	Learn to manage the resources in IoT

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**3**		
CO2	**2**		**3**	**2**	
CO3	**2**		**3**	**2**	**1**
CO4			**3**		

COURSE CONTENT

UNIT I

THE INTERNET OF THINGS

Introduction; The Basic Concepts: Interaction with the Internet, Major components of IoT devices - Control Units – Sensors - Communication Modules - Power Sources; Communication Technologies: RFID –

Bluetooth – ZigBee - WiFi - RF Links - Mobile Internet - Wired Communication;

IoT ARCHITECTURE

IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

UNIT II

8051 MICROCONTROLLER

Introduction to Microcontrollers, The 8051 Instruction Set, AT89S8253 Microcontroller, Assembly Language, Examples, Development systems.

IoT PLATFORM

IoT Platform overview, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

UNIT III

PROGRAMMING THE MICROCONTROLLER FOR IOT

BASICS OF SENSORS & ACTUATORS

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors;

COMMUNICATION: Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using wifi / Ethernet

IoT PHYSICAL DEVICES AND ENDPOINTS

Basic building blocks of an IoT Device - Introduction to Raspberry PI- Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, and reading input from pins.

UNIT IV

RESOURCE MANAGEMENT IN THE INTERNET OF THINGS

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of

Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and
Autonomy-Enabling Autonomy and Agility by the Internet of Things- Technical Requirements for Satisfying the New Demands in Production - Challenges by Developing the Internet of Things.

APPLICATIONS OF IOT

IoT Applications - Smart Grid – Electrical Vehicle Charging – Smart Cities: Smart Parking, Traffic Congestion, Waste Management, Smart Lighting, Air Pollution, Portable water monitoring.

TEXT BOOKS

[1] Charalampos Doukas "Building Internet of Things With the Arduino", CreateSpace Independent Publishing Platform, 2012.

[2] Arshdeep Bahga , Vijay Madisetti "Internet of Things (A Hands-on-Approach)" 1st Edition VPI publishers, 2014.

[3] Milan Verle, "Architecture and Programming of 8051 Microcontrollers" 1st Edition mikro Elektronika (**eBook** Online) 2009.

[4] Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

[5] Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi" O'Reilly (SPD), 2014.

REFERENCE BOOKS

[1] Luigi Atzor et.al, "The Internet of Things: A survey", Journal on Networks, Elsevier Publications, October, 2010

[2] Web Link 1: http://postscapes.com/(Accessed on 16 February 2016).

[3] Web Link 2: http://www.theinternetofthings.eu/what-is-the-internet-of-things(Accessed on 16 February 2016)

[4] Web Link 3:http://www.arm.com/products/processors/(Accessed on 16 February 2016)

[5] Web Link 4: https://www.arduino.cc/en/ ArduinoCertified/IntelGalileo (Accessed on 16 February 2016)

[6] Web Link 5: http://www.libelium.com/top_50_iot_ sensor_applications_ ranking/ (Accessed on 16 February 2016).

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Lecture Series on **"Introduction to Internet of Things"** by Prof. Raj Jain, Washington University, Available at: https://www.youtube.com/watch?v=oc_qzTj26k&list=PLw5h0DiJ9PCxDZkP8pbgpyiDweF3DJ8c (Accessed on 16 February 2016)

15CSCS2003
CLOUD COMPUTING

Course Category:	Programming Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the evolution of cloud computing paradigm and its architecture
CO2	Explain and characterize different cloud deployment models and service models
CO3	Identify the various technological drivers of cloud computing paradigm
CO4	Identify the security issues in cloud computing

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**2**		
CO2			**2**	**1**	
CO3			**3**	**2**	
CO4	**1**			**2**	

COURSE CONTENT

UNIT I

Computing Paradigms

High-Performance Computing, ParallelComputing, DistributedComputing, Cluster Computing, Grid Computing, Cloud Computing, Biocomputing, Mobile Computing, Quantum Computing, Optical Computing, Nanocomputing, Network Computing

Cloud Computing Fundamentals

Motivation for Cloud Computing: The Need for Cloud Computing.

Defining Cloud Computing: NIST Definition of Cloud Computing, Cloud Computing Is a Service, Cloud Computing Is a Platform

5-4-3 Principles of Cloud computing:Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models

Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks

Cloud Computing Architecture and Management

Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud

UNIT II

Cloud Deployment Models : Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud

Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models

Technological Drivers for Cloud Computing: SOA and Cloud: SOA and SOC, Benefits of SOA, Technologies Used by SOA, Similarities and Differences between SOA and Cloud Computing. Virtualization: Approaches in Virtualization, Hypervisor and Its Role, Types of Virtualization Multi-core Technology, Memory and Storage Technologies, Networking Technologies Web 2.0, Web 3.0.

UNIT III

Programming Models in Cloud: BSP Model, Map Reduce Model, SAGA, Tansformer, Grid Batch Framework

Operating Systems: Role of OS in Cloud Computing, Features of Cloud OS, Cloud OS Requirements, Cloud-Based OS Application Environment

Application Environment: Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application Development, Cloud Application Development Platforms: Windows Azure, Google App Engine, Force.com, Manjrasoft Aneka

Cloud Computing APIs: Rackspace, IBM, Intel

Networking for Cloud Computing Overview of Data Center Environment, Networking Issues in Data Centers

UNIT IV

Open Source Support for Cloud: Introduction, Open Source in Cloud Computing: An Overview, Difference between Open Source and Closed Source, Advantages of Having an Open Source

Open Source Tools for IaaS: Eucalyptus, Open stack Open Source Tools for PaaS: Red Hat Open Shift Origin Open Source Tools for SaaS: Google Drive, Drop box

Open Source Tools for Research: Cloud Sim

Security Aspects

Data Security, Virutalization Security, Network Security Platform-Related Security Security Issues in Cloud Service Models, Software-as-a-Service Security Issues, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues

Advanced Concepts in Cloud Computing

Intercloud, Cloud Management, Mobile Cloud, Media Cloud, Interoperability and Standards, Cloud Governance, Computational Intelligence in Cloud, Green Cloud, Cloud Analytics

TEXT BOOKS

[1] K. Chandrasekaran, Essentials of Cloud Computing, CRC Press, 2015

REFERENCE BOOKS

[1] Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010

[2] RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011

[3] Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012

15CSCS2004A
ALGORITHMS FOR BIO-INFORMATICS

Course Category:		**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand Dynamic programming algorithms for biological sequences
CO2	Understand graph algorithms and their applications
CO3	Apply pattern matching and clustering with reference to Bioinformatics
CO4	Analyze evolutionary trees and phylogeny related algorithms
CO5	Compare Hidden Markov Models and randomized algorithms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**		**3**	**3**	
CO2	**1**		**3**	**3**	
CO3	**1**		**3**	**3**	
CO4	**1**	**2**	**3**	**3**	
CO5	**1**				

COURSE CONTENT

UNIT I

Algorithms and Complexity: Biological Algorithms versus Computer Algorithms, The Change Problem, Correct versus Incorrect Algorithms, Recursive Algorithms, Iterative versus Recursive Algorithms, Fast versus Slow Algorithms, Big-O Notation, Algorithm Design Techniques-Exhaustive Search, Branch-and-Bound Algorithms, Greedy Algorithms, Dynamic Programming, Divide-and-Conquer Algorithms, Machine Learning, Randomized Algorithms; Tractable versus Intractable problems

Exhaustive Search: Restriction Mapping, Impractical Restriction Mapping Algorithms, A Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, The Motif Finding Problem, Search Trees, Finding Motifs, Finding a Median String.

UNIT II

Greedy Algorithms: Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints:A Different Face of Greed, A Greedy Approach to Motif Finding.

Dynamic Programming, Algorithms: The Power of DNA Sequence Comparison, The Change Problem, Revisited, The Manhattan Tourist Problem, Edit Distance and Alignments, Longest Common subsequences, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap Penalties, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment.

Divide-and-Conquer Algorithms: Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Subquadratic Time

UNIT III

Graph Algorithms: Graphs, Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum

Graphs, Protein Identification via Database Search, Spectral Convolution, Spectral Alignment.

Combinatorial Pattern Matching: Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching, BLAST: Comparing a Sequence against a Database.

UNIT IV

Clustering and Trees: Gene Expression Analysis, Hierarchical Clustering, k-Means Clustering, Clustering and Corrupted Cliques, Evolutionary Trees, Distance-Based Tree Reconstruction, Reconstructing Trees from Additive Matrices, Evolutionary Trees and Hierarchical Clustering, Character-Based Tree Reconstruction, Small Parsimony Problem, Large Parsimony Problem.

Hidden Markov Models: CG-Islands and the Fair Bet Casino, The Fair Bet Casino and Hidden Markov Models, Decoding Algorithm, HMM Parameter Estimation, Profile HMM Alignment.

TEXT BOOKS

1. Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", MIT Press, 2005.
2. Gusfields D, "Algorithms on strings, trees and sequences: Computer Science and Computational Biology", Cambridge University Press, 1997.

REFERENCE BOOKS

1. Steffen Schulze-Kremer, " Molecular Bioinformatics: Algorithms and Applications", Walter de Gruyter, 1996.
2. Gary Benson, Roderic Page (Eds.), "Algorithms in Bioinformatics", Springer International Edition, 2004.
3. Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison. "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acid", Cambridge University Press, 1999.

15CSCS2004B
GRID COMPUTING

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the architecture, services and instantiations of the Grid.
CO2	Differentiate various grid monitoring related techniques.
CO3	Analyze security issues and working of scheduling paradigms in grids.
CO4	Understand the importance network security tools and applications.
CO5	Analyze about various available grid middleware's.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**2**		**3**	**3**	
CO2	**3**		**2**		**3**
CO3	**3**		**2**	**3**	
CO4	**3**		**2**	**3**	
CO5	**3**		**2**	**3**	

COURSE CONTENT

UNIT I

Concepts and Architecture

Introduction-Parallel and Distributed Computing-Cluster Computing-Grid ComputingAnatomy and Physiology of Grid-Review of Web Services-OGSA-WSRF

Grid Monitoring

Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- Grid ICE – JAMM -MDS-Network Weather Service-R-GMA-Other Monitoring SystemsGanglia and GridMon

UNIT II

Grid Security and Resource Management

Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid Scheduling and Resource Management-Scheduling Paradigms- Working principles of Scheduling -A Review of Condor, SGE, PBS and LSF-Grid Scheduling with QoS.

UNIT III

Data Management and Grid Portals

Data Management-Categories and Origins of Structured Data-Data Management Challenges-Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-First-Generation Grid Portals-Second-Generation Grid Portals

UNIT IV

GRID MIDDLEWARE

List of globally available Middlewares, Case Studies – Globus Toolkit – GT3 Software architecture model, Globus Toolkit – GT3 Software architecture model - Load balancing, Globus GT3 Toolki: Programming Model, Globus GT3 Toolkit: Implementation, Globus GT3 Toolkit: High-level services, gLite – Middleware services, Job management, gLite – Services, WMS – Architecture, Components, Features.

TEXT BOOKS

[1] Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley &Sons, 2005.

REFERENCE BOOKS

[1] Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrascture Morgan Kaufman, 2004.

[2] Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson Education, 2004.

[3] Fran Berman,Geoffrey Fox, Anthony J.G.Hey, "Grid Computing: Making the Global Infrastructure a reality", John Wiley and sons, 2003.

15CSCS2004C
PATTERN RECOGNITION

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts of pattern recognition system
CO2	Apply the principles of Bayesian Decision Theory and Non Parametric Technique in simple Probabilistic models.
CO3	Apply the Maximum Likelihood and Bayesian parameter estimations for Complex probabilistic models
CO4	Analyze the Concept of Linear Discriminant function and Multi Layer Neutral Network.
CO5	Analyze Various HMMs Models and Apply the concepts of unsupervised learning and clustering

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**		**1**		
CO2	**2**		**2**		
CO3	**2**		**2**		
CO4	**2**		**2**		
CO5	**3**		**3**	**3**	

COURSE CONTENT

UNIT I

Introduction to Pattern Recognition System: Machine perception; pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation: Supervised , Non Supervised and reinforment Learning.

Bayesian Decision Theory: Introduction, continuous features, minimum error-rate classification- classifiers, discriminant functions, and decision surfaces, Normal density, discriminant functions for the normal density, Bayes decision theory – discrete features, missing and noisy features, Bayesian belief networks, compound Bayesian decision theory and context.

UNIT II

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case, Bayesian parameter estimation–General Theory, Problems of Dimensionality, component analysis and discriminants.

Nonparametric Techniques: Introduction, Density estimation, Parzen windows, Kn-Nearest neighbor estimation, Nearest –neighbor rule, Fuzzy classification.

UNIT III

Linear Discriminant Functions: Linear Discriminant functions and decision surfaces, Generalized Linear Discriminant functions, Logistic Regression, SVM-Support Vector Machine.

Multilayer Neural Networks: Feed forward operation and classification, Back propagation algorithm, Back propagation as feature mapping.

UNIT IV

Unsupervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, Data description and clustering, criteria function for clustering, Mixture of Gaussians, EM algorithm.

Discrete Hidden Markov Models : Introduction, Discrete–time markov

process, extensions to hidden Markov models, three basic problems for HMMs, Types of HMMs, Continuous Observation densities in HMMs.

TEXT BOOKS

[1] Richard O. Duda, Peter E. Hart and David G. Stroke, "Pattern Classifications", 2 Edition Wiley Student Edition 2006

[2] LawerenceRabiner and Biing Hwang, Fundamentals of Speech Recognition. Pearson Education.

[3] Christopher Bishop, "Pattern Recognitoin and Machine Learning," Springer, 2007.

REFERENCE BOOKS

[1] S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

[2] Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

[3] Devi V.S.; Murty M.N, "Pattern Recognition: An Introduction", Universities Press, Hyderabad. 2011.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Lecture Series on Computer Organization by Prof. P.K.Biswas, IIT Kharagpur, Pattern Recognition, Available at: http://nptel.ac.in/courses/ 117105101/ (Accessed on 16.02.2016).

15CSCS2004D
SOFTWARE PROJECT MANAGEMENT

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand various project management activities
CO2	Identify the appropriate process model for a software project
CO3	Estimate different software project metrics
CO4	Asses various kinds of risks associated with software projects
CO5	Perform various project monitoring and closure activities

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**				
CO2	**1**		**2**	**2**	
CO3	**1**		**2**	**2**	
CO4	**1**		**2**	**2**	
CO5			**1**	**2**	

COURSE CONTENT

UNIT I

Introduction to software Project management: Introduction, Project definition, why is software project management important, what is a project, software project Vs types of project, contract management, Activities covered by software project management, plans, methods and methodologies, categorizing software projects.

An overview of Project planning: Stepwise project planning, step 0-select project, step1- Identify project scope, step2- Identify project infrastructure, step3- Analyze project characteristics, step4-- Identify project product and activities,step5- Estimate effort for each activity, step6- Identify activity risks, step7- Allocate resources, step8- Review/Publicize plan, step9/10-Execute plan/lower levels of planning.

Selection of an appropriate project approach: Introduction, Build or Buy, choosing methodologies and technologies, choice of process models, structure Vs speed of delivery, The water fall model, The spiral model, software prototyping, other ways of categorizing prototypes, Incremental delivery, Agile methods ,XP, Selecting the most appropriate process model

UNIT II

Product Metrics: A frame work for product metrics, Metrics for requirements model, Metrics for design model, Metrics for web apps, Metrics for source code, Metrics for testing, Metrics for maintenance.

Metrics for Process and Project: Metrics in the process and project Domains, software measurements, metrics for software quality, integrating metrics within software process, metrics for small organizations, establishing a software metrics program.

Estimation: Observations, Project planning Process, software scope and feasibility,resources, software project estimation, decomposition techniques, empirical estimationmodels, estimation for object oriented projects, estimation for Agile development andweb engineering projects, the make/buy decision

UNIT III

Activity Planning: Objectives, Project schedule, Sequencing and scheduling activities, Network planning models, Forward pass, backward pass, Activity

float, shortening project duration, Activity on arrow networks.

Risk Management: reactive Vs proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation, monitoring and management, The RMMM plan

Quality Planning: Quality Concepts, Procedural Approach to Quality Management, Quantitative Approaches to Quality Management, Quantitative Quality ManagementPlanning, Setting the Quality Goal, Estimating Defects for Other Stages, Quality ProcessPlanning, Defect Prevention Planning.

UNIT IV

Reviews: The Review Process, Planning, Overview and Preparation, Group ReviewMeeting, Rework and Follow-up, One-Person Review, Guidelines for Reviews inProjects, Data Collection, Analysis and Control Guidelines, Introduction of Reviews andthe NAH Syndrome.

Project Monitoring and Control: Project Tracking, Activities Tracking, DefectTracking, Issues Tracking, Status Reports, Milestone Analysis, Actual Versus EstimatedAnalysis of Effort and Schedule, Monitoring Quality, Risk-Related Monitoring.

Project Closure: Project Closure Analysis, The Role of Closure Analysis, Performing, Closure Analysis

TEXT BOOKS

[1] Bob Hughes, Mikecotterell, Software Project Management, Tata McGraw Hill, 2010.Unit-1

[2] RogerS. Pressman,Software Engineering-A Practitioner's Approach, Tata McGraw Hill,7th ed.Unit-2 & 3

[3] Pankaj Jalote, Software project management in practice, Addison-Wesley, 2002.Unit-3, Unit-4

REFERENCE BOOKS

[1] Watts S.Humphrey Managing the Software Process, Pearson Education, 2011.

[2] Royce W, Software project Management: A Unified Framework".Addison-Wesley,1998

15CSCS2004E
COMPUTER VISION

Course Category:	Institutional Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts of computer vision and image transformations
CO2	Outline the feature detection and matching techniques to the given images
CO3	Demonstrate appropriate segmentation technique to recognize the object
CO4	Estimate 3-D geometry Structure with multiple camera poses.
CO5	Compare dense motion estimation models.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**		**3**	**2**	
CO2	**3**		**2**	**2**	
CO3	**2**		**2**	**2**	
CO4	**2**		**3**	**3**	
CO5	**3**				

COURSE CONTENT

UNIT I

Introduction to computer vision – introduction, brief history, Image Formation - Geometric primitives and transformations, Photometric image formation, the digital camera

Image transforms: point operators, linear filtering, more neighbourhood operators, Fourier transforms

UNIT II

Feature detection and matching: points and patches, edges, lines

Segmentation: split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

UNIT III

Structure from Motion: Triangulation, Two-frame structure from motion, Self-calibration, Factorization, Perspective and projective factorization.

Translation Alignment: Hierarchical motion estimation, Fourier-based alignment, Incremental refinement.

UNIT IV

Dense Motion Estimation: Parametric motion-Learned motion models, Spline based motion and optical flow-Multi-frame motion estimation.

Recognition: Object detection and Face recognition.

TEXT BOOKS

[1] Rick Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010

REFERENCE BOOKS

[1] Frosyta and Ponce "Computer Vision: A Modern Approach" , 2nd edition, PHI, 2003

[2] Rafael C. Gonzalez and Richard E Woods, Digital Image Processing. 2 ed, PHI/Pearson Education, 2003

15CSCS2004F

CYBER SECURITY

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic concepts of Cyber Security
CO2	Assess different cyber crimes.
CO3	Analyze various tools and methods used in cyber crimes.
CO4	Apply information systems in mobile devices to overcome security challenges.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**3**		**2**		
CO2	**2**		**3**		
CO3	**3**		**3**		
CO4	**2**		**2**		**2**

COURSE CONTENT

UNIT I

Introduction of Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals

Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web

Jacking, Hacking, Online Frauds, Pornographic Offenses , Software Piracy, Computer Sabotage, E-Mail Bombing/Mail Bombs, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft

Cyber offenses: Criminals Plan, Categories of Cybercrime

UNIT II

Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, and Classification of Social Engineering

Cyberstalking: Types of Stalkers, Cases Reported on Cyberstalking, Working of Stalking, Real-Life Incident of Cyber stalking, Cybercafe and Cybercrimes,

Botnets: The Fuel for Cybercrime, Botnet, Attack Vector

Cloud Computing: Importance of Cloud Computing, Types of Services, Cybercrime and Cloud Computing.

UNIT III

Cybercrime: Mobile and Wireless Devices: Proliferation, Trends in Mobility, Credit card frauds, security challenges, Registry settings, Authentication service security, Attacks on Mobile/Cell Phones, Mobile devices security implications and measures for organisation, Laptops.

UNIT IV

Tools and Methods used in Cyber crime: Proxy Servers and Anonymizers, Phishing and Identity Theft : Working of Phishing, Identity Theft (ID Theft),

Password Cracking: Online Attacks, Offline Attacks, Strong, Weak and Random Passwords, Random Passwords,

Keyloggers and Spywares: Software Keyloggers, Hardware Keyloggers, Antikeylogger, Spywares,

Virus and Worms: Trojan Horses and Backdoors,

Steganography: Steganalysis, **DoS and DDoS Attacks**: DoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

TEXT BOOKS

[1] Nina Godbole, Sunit Belapur, “Cyber Security Understanding Cyber Crimes,

Computer Forensics and Legal Perspectives", 2nd edition, Wiley India Publications, April, 2011

REFERENCE BOOKS

1. Alfred basta , Wolf halton, "computer security: concepts, issues, and implementation", 2nd ed cengage India, 2010
2. Behrouz A. Forouzan, "*Data Communications and Networking".* 4 ed, TMH, 2007.
3. William Stallings, Cryptography and Network Security: Principles and Practice. 5th Ed, Pearson Education, 2013

15CSCS2004G
AD HOC AND SENSOR NETWORKS

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Know the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2	Analyze the protocol design issues of ad hoc and sensor networks
CO3	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
CO4	Evaluate the QoS related performance measurements of ad hoc and sensor networks

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**2**				
CO2		**1**	**1**		
CO3			**1**		
CO4				**2**	

COURSE CONTENT

UNIT I

INTRODUCTION: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms –

Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT II

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

UNIT III

ROUTING PROTOCOLS AND TRANSPORT LAYER IN A D HOC WIRELESS NETWORKS: Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT IV

WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS: Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

WSN ROUTING, LOCALIZATION & QOS: Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

TEXT BOOKS

[1] C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

REFERENCE BOOKS

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

15CSCS2005A
INFORMATION RETRIEVAL SYSTEMS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the overview of Information Retrieval Systems
CO2	Compute the process of indexing and Information Extraction
CO3	Learn the stemming algorithms and implement with various data structures
CO4	Understand the concepts of term clustering and Information Visualization
CO5	Learn various text search algorithms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**				
CO2		**2**		**1**	
CO3		**2**			
CO4			**2**	**1**	
CO5			**2**	**1**	

COURSE CONTENT

UNIT I

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.

Information Retrieval System Capabilities: Search, Browse, Miscellaneous.

UNIT II

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing,

Information Extraction.

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

UNIT III

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages.

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT IV

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext.

Information Visualization: Introduction, Cognition and perception, Information visualization technologies.

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems.

Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results

TEXT BOOKS

[1] M. T. M. Gerald J Kowalski, Information Storage and Retrieval Systems: Springer International Edition, 2005.

REFERENCE BOOKS

1. W. B. Frakes, Ricardo Baeza-Yates, Information Retrieval Data Structures and Algorithms: Prentice Hall PTR, 2000.
2. R. Baeza-Yates, Modern Information Retrival: Pearson Education, 2000.
3. R. Korfhage, Information Storage & Retrieval: John Wiley & Sons, 2006.

15CSCS2005B

REAL TIME SYSTEMS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Know the Basic Concepts Of Real Time Systems
CO2	Compare General Purpose Databases with Real Time
CO3	Analyze Various Real Time Communication Techniques
CO4	Compare Various Reliability Evaluation Techniques

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**				
CO2		**2**	**1**		
CO3			**2**		
CO4				**2**	**2**

COURSE CONTENT

UNIT I

INTRODUCTION: Issues in Real Time Computing, Structure of a Real Time System. Task Classes, Performance Measures for Real Time Systems, Estimating Program Run times. Task Assignment andScheduling - Classical Uniprocessor scheduling algorithms, UniProcessor scheduling of

IRIS Tasks, TaskAssignment, Mode Changes, and Fault Tolerant Scheduling.

UNIT II

PROGRAMMING LANGUAGES AND TOOLS: Desired Language characteristics, Data Typing, Controlstructures,Facilitating Hierarchical Decomposition, Packages, Runtime (Exception) Error handling, Overloading andGenerics, Multitasking, Low Level programming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

UNIT III

REAL TIME DATABASES: Basic Definition, Real time Vs General Purpose Databases, Main MemoryDatabases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk SchedulingAlgorithms, Twophase Approach to improve Predictability, Maintaining Serialization Consistency, Databasesfor Hard Real Time systems.

UNIT IV

COMMUNICATION: Real-Time Communication - Communications Media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques Fault Types, Fault Detection. Fault Error containment Redundancy,Data Diversity, Reversal Checks, Integrated Failure handling. Reliability Evaluation Techniques Obtaining Parameter Values, Reliability Models for HardwareRedundancy, Software Error models. Clock Synchronization - Clock, A NonfaultTolerant SynchronizationAlgorithm, Impact of Faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in Software.

TEXT BOOKS

[1] C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, 1997.

REFERENCE BOOKS

1. Stuart Bennett, "Real Time Computer Control- An Introduction", Second edition, Perntice Hall, 1994.

2. Peter D. Lawrence, "Real time Micro Computer System Design – An Introduction", McGraw Hill, 1988.

3. S.T. Allworth and R.N. Zobel, "Introduction to real time software design", Macmillan, II Edition, 1987.

15CSCS2005C
NATURAL LANGUAGE PROCESSING

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the basic Notation in natural language processing.
CO2	Solve NLP sub problems using tokenizing and tagging
CO3	Apply various Parsing Techniques in NLP.
CO4	Analyze the semantic of sentences
CO5	Know the concepts of Machine Translation approaches.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**1**				
CO2	**2**			**1**	
CO3	**3**			**1**	
CO4	**2**				
CO5	**1**				

COURSE CONTENT

UNIT I

Introduction – Models and Algorithms, **Regular Expressions and Automata -**

Regular Expression - Basic Regular Expression Patterns, Disjunction, grouping, and precedence, Finite State Automata – using an FSA to recognize sheeptalk, formal languages, Non-Deterministic FSAs, Using an NFAs to accept strings, Recognition as search, Relating Deterministic and Non Deterministic Automata. Regular Languages and FSAs, **Morphology and Finite-State Transducers** survey of English Morphology -Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing – The lexicon and Morphotactics, Morphological parsing with finite state transducers, orthographic rules and finite state transducers, Combining an FST Lexicon and Rules, the Porter Stemmer, Human Morphological Processing.

UNIT II

N-grams- Counting Words in Corpora, Unsmoothed N-grams, Smoothing – Add-One smoothing, witten-Bell Discounting, Good-Turing Discounting, Backoff, Deleted Interpolation, N-Grams for spelling and Pronunciation, context-sensitive spelling error correction, N-grams for pronunciation Modelling, Entropy- Cross entropy for comparing models, the entropy of English. **Word Classes and Part-of-Speech Tagging**- English Word Classes, Tagsets for English, Part of Speech Tagging, Rule-Based Part of Speech Tagging, Stochastic Part of Speech Tagging, Transformation-Based Tagging – How TBL rules are applied, How TBL rules are Learned.

UNIT III

Context Free Grammars for English- Constituency, Context-Free Rules and Trees, Sentence- Level Constructions, the Noun Phrase, Coordination, Agreement, The Verb phrase and Sub Categorization, Auxiliaries, spoken language syntax, grammar equivalence and normal form, finite state and context free grammars, grammars and human processing. **Parsing with Context Free Grammars –** Parsing as Search – top-down parsing, bottom-up parsing, comparing top-down and bottom-up parsing, A Basic Top-Down Parser, problems with the basic top down parser, left recursion, ambiguity,

repeated parsing of subtrees, The Earley Algorithm, Finite State Parsing Methods.

UNIT IV

Semantic Analysis –Syntax, Driven Semantic Analysis – semantic augmentations to context free grammar rules, quantifier scoping and the translation for complex terms, attachments for a fragment of English, sentences, noun phrases, verb phrases, prepositional phrases, integrating semantic analysis into the early parser.

Lexical Semantics: Relations among lexemes and their senses, homonymy, polysemy, synonymy, hyponymy, wordnet, the internal structures of words.

Machine Translation – language similarities and Differences, the transfer Metaphor, syntactic Transformations, Lexical Transfer, The Interlingua Idea: using meaning, Direct Translation, using statistical techniques.

TEXT BOOKS

[1] D. Jurafsky and J. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" low price edition, Pearson Education, 2005.

REFERENCE BOOKS

1. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press,1999.
2. James Allen. "Natural Language Understanding", Addison Wesley, 1995.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://nptel.iitm.ac.in/courses/106101007/ (Accessed on 16/02/2016)

15CSCS2005D
SOFTWARE RELIABILITY AND TESTING

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand basic software reliability concepts.
CO2	Identify failures and faults for a software product
CO3	Apply structural and functional testing techniques
CO4	Choose appropriate testing technique at different stages

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**				
CO2	**1**		**2**	**2**	
CO3	**1**		**2**	**2**	
CO4	**1**		**2**	**2**	

COURSE CONTENT

UNIT I

Overview of Software Reliability Engineering: Software reliability engineering process -Fone Follower-Types of test-systems to test-effectiveness and benefits-concepts-relations with other practices-application-software reliability concepts-Reliability- hardware and software reliability-

software reliability modeling.

Defining Necessary Reliability: Failure and fault-Failure severity classes-Failure intensity-procedure-special situations-Definition of failure-failure severity classes-setting failure intensity objectives-concepts-Applications-Defining failure with severity classes-setting failure system intensity objectives-Availability-Reliability combinatorics.

Developing operational profiles: Concepts- procedure- special situations.

UNIT II

Software reliability models: General characteristics-classification-comparison-recommended models.

Deploying software reliability engineering: Persuasion-Executing the deployment-Using a consultant.

Preparing for test: Concepts-Procedure-Preparing test cases-Preparing test procedures-test efficiency- increasing test efficiency by using Run categories.

Executing test: Allocating test time-invoking test-identifying system failures-special situations

UNIT III

Types of Testing:

White box testing: What is white box testing-static testing, structural testing-Challenges in white box testing.

Black box testing: What is Black box testing- why Black box testing-when to do Black box testing- How to do Black box testing.

Integration testing: What is Integration testing- Integration testing as a type of testing- Integration testing as a phase of testing- scenario testing.

System and acceptance testing: System testing overview- why is System testing done-Functional Vs Non-Functional testing-Functional testing-Non-Functional testing.

UNIT IV

Performance testing: Introduction- factors governing Performance testing-methodology for Performance testing- tools for Performance testing- process for Performance testing.

Regression testing: What is Regression testing-Types of Regression testing-

when to do Regression testing-How to do Regression testing-Best practices in Regression testing.

Ad hoc testing: Buddy testing-pair testing-Exploratory testing- Iterative testing-Agile and Extreme testing- Defect seeding- conclusion.

Usability and accessibility testing: What is Usability testing- Approach to Usability- When to do Usability testing- How to achieve usability- Quality factors for usability- Aesthetics testing-Accessibility testing- Tools for usability

TEXT BOOKS

[1] John D. Musa, " Software Reliability", McGraHill, 1999.**unit-1, unit-2**

[2] Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2007**. unit-3, unit-4**

REFERENCE BOOKS

[1] William Perry, "Effective Methods of Software Testing", Third Edition, Wiley Publishing 2007

[2] Patric D. T.O connor," Practical Reliability Engineering" , 4th Edition, John Wesley & sons , 2003.

[3] Anderson and PA Lee : " Fault tolerance principles and Practice ", PHI ,1981

[4] Naresh Chauhan, "Software Testing Principles and Practices" Oxford University Press, New Delhi, 2010.

15CSCS 2005 E
BIOMETRICS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the fundamentals and standards of biometric systems.
CO2	Distinguish physical and behavior biometric characteristics.
CO3	Learn different biometric user interfaces.
CO4	Understand biometric technology for different security applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**				
CO2	**1**				
CO3	**2**		**2**		
CO4	**3**		**3**	**3**	

COURSE CONTENT

UNIT I

BIOMETRIC FUNDAMENTALS AND STANDARDS: Definition, Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification - Identification - Biometric matching, Performance measures in biometric systems, Assessing the privacy risks of biometrics - Designing privacy sympathetic

biometric systems, Different biometric standards, Application properties.

UNIT II

PHYSIOLOGICAL BIOMETRICS: Facial scan, Ear scan, Retina scan, Iris scan, Finger scan, Automated fingerprint identification system, Palm print, Hand vascular geometry analysis, DNA, Dental.

BEHAVIOURAL BIOMETRICS: Signature scan, Keystroke scan, Voice scan, Gait recognition, Gesture recognition, Video face, Mapping the body technology.

UNIT III

USER INTERFACES: Biometric interfaces: Human machine interface - BHMI structure, Human side interface: Iris image interface - Hand geometry and fingerprint sensor, Machine side interface: Parallel port - Serial port - Network topologies, Case study: Palm Scanner interface.

UNIT IV

BIOMETRIC APPLICATIONS: Categorizing biometric applications, Application areas: Criminal and citizen identification – Surveillance - PC/network access - E-commerce and retail/ATM, Costs to deploy, Issues in deployment, Biometrics in medicine, cancellable biometrics.

TEXT BOOKS

[1] Anil K Jain, Patrick Flynn and Arun A Ross, "Handbook of Biometrics", Springer, USA, 2010.

[2] John R Vacca, "Biometric Technologies and Verification Systems", Elsevier, USA, 2007.

[3] Samir Nanavati, Michael Thieme and Raj Nanavati, "Biometrics – Identity Verification in a Networked World", John Wiley & Sons, New Delhi, 2003

REFERENCE BOOKS

[1] Paul Reid, "Biometrics for Network Security", Pearson Education, New Delhi, 2004.

[2] Ruud M. Bolle et al, "Guide to Biometrics", Springer, USA, 2003.

[3] David D Zhang, "Automated Biometrics: Technologies and Systems", Kluwer Academic Publishers, New Delhi, 2000.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Lecture Series on Computer Organization by Prof. Phalguni Gupta IIT Kanpur, Biometrics (Video) Available at: http://nptel.ac.in/courses/106104119/

15CSCS2005F

DIGITAL AND CYBER FORENSICS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic concepts of forensics.
CO2	Identify the data evidence and tools in computer investigation.
CO3	Analyze various forensics technologies
CO4	Apply Investigative services on various Forensic systems

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**3**		**2**		
CO2	**2**		**3**		
CO3	**2**		**2**		
CO4	**2**		**1**		**2**

COURSE CONTENT

UNIT I

Introduction Computer Forensics: Introduction, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensics life cycle,

Evidential potential of digital devices – Key developments, Digital devices

in society, Technology and culture, Comment, Closed vs. open systems, evaluating digital evidence potential. Device Handling & Examination Principles: Seizure issues, Device identification, Networked devices, Contamination, Previewing, Imaging, Continuity and hashing, Evidence locations.

UNIT II

Evidence creation and Interpretation: A seven element security model, A developmental model of digital systems, Knowing, Unknowing, Audit and logs, Data content, Data context.

Forensic Tools: Evaluating Computer Forensics Toll Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software

UNIT III

Types of Computer Forensics Technologies: Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised, Internet Tracing Methods.

UNIT IV

Types of Computer Forensic Systems & Services: Internet Security System, Storage Area Network Security System, Public Key Infrastructure System, Satellite Encryption, Instant Message, Biometric and Home Land security systems. **Computer Forensics Services:** Occurrence of Cyber Crime, Cyber Detectives, Fighting Cyber Crime with Risk Management Techniques, Computer Forensics Investigative Services, Forensic Process Improvement.

TEXT BOOKS

1. Angus M.Mashall, "Digital Forensics", 2nd Edition,Wiley Blackwell, A John Wiley & Sons Ltd Publication, 2008.

2. John R. Vacca, "Computer forensics: Computer Crime Scene Investigation",

2 nd Edition, Charles River Media, Inc. Boston, Massachusetts, 2011.

REFERENCE BOOKS

1. Nina Godbole, Sunit Belapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", 2nd Edition, Wiley India Publications, April, 2011

2. Bill Nelson,Amelia Philips and Christopher Steuart, "Guide to computer forensics and investigations", course technology, Cengage Learning; 4 thedition, ISBN: 1-435-49883-6, 2009

3. Robert M.Slade, "Software Forensics Collecting Evidence from the scene of a Digital Crime". TMH 2005

15CSCS2005G
WIRELESS AND MOBILE NETWORKS

Course Category:	Programme Elective	**Lecture-Tutorial-Practice:**	4-0-0
Course Type:	Theory	**Continuous Evaluation:**	40
Credits:	4	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of Cellular communication Systems and Standards.
CO2	Analyze Telecommunication and Satellite Communication Systems.
CO3	Compare the technologies of 3G, 4G and 5G communications.
CO4	Analyze principles and protocols for different types of Wireless network architectures.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**2**		
CO2			**2**	**1**	
CO3	**1**		**3**	**2**	
CO4	**1**			**2**	

COURSE CONTENT

UNIT I

Wireless Systems and Standards: First Generation Cellular Systems, Second Generation Cellular Systems, GSM/DCS1800/PCS1900, IS-54/136 and IS-95, PDC, Cordless Telephone Systems, Third Generation Cellular Systems,

Wireless LANs and and PANs, Frequency Reuse and the Cellular Concept, Mobile Radio Propagation Environment, Co-channel Interference and Noise, Receiver Sensitivity and Link budget, Coverage, Spectral efficiency and Capacity, Software defined network.

Telecommunications systems: GSM, Mobile Services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New Data Services.

Satellite systems: History, Applications, Basics: GEO, LEO, MEO.

UNIT II

Third Generation (3G) Overview: UMTS, Services, Air Interface, 3GPP release 1999 Network architecture, Release 4 architecture, Release 5 All-IP architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000,TD-CDMA and TD-SCDMA.

Universal Mobile Telecommunications: The WCDMA Air Interface, The UTRAN Architecture, Establishment of a UNTS Speech Call, UMPTS Packet Data, High speed packet Data, Handover, HSPA Connection Establishment.

UNIT III

Long-Term Evolution: LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, UE, eNodeB, Core Network, Radio Channel Components, TD-LTE, MIMO, LTE Scheduler, Carrier aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover, SONs, Relay Cells, HetNET, RRH, VoLTE, LTE Advanced.

5G and Beyond: Technology path, smart phones and wireless Broadband Edge Device(WBED), Software-Defined Radio(SDR), Millimeter Wave Backhaul, Applications, Services, Advanced Broadband Wireless Access, Multimedia(Mobile TV), MVNO.

UNIT IV

Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs)

Mobile Ad-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks –

Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

TEXT BOOKS

[1] Gordan L. Stuber, "*Principles of Mobile Communication*", Springer, 2011. (UNIT-I)

[2] Mobile communications Jochen H.Schiller, 2nd edition, Pearson Education. (UNIT-I)

[3] Clint Smith, Daniel Collins, "**Wireless Networks-Design and Integration for LTE,EVDO,HSPA and WIMAX**", Third Edition, McGraw Hill, 2014. (UNIT-II&III)

[4] Nader F. Mir, Computer *and Communication Network.* Pearson Education, 2007.(UNIT-IV)

REFERENCE BOOKS

[1] Rappaport T.S., "Wireless Communications; Principles and Practice", Pearson Education, 2010.

[2] William Stallings, "Wireless Communication & Networking", Pearson Education Asia, 2010.

15CSCS2051
BIG DATA ANALYTICS LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	0-0-3
Course Type:	Lab	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the concepts of Big Data Analytics
CO2	Apply machine learning algorithms for Big Data Analytics
CO3	Apply text categorization algorithms
CO4	Solve the Big Data Analytics problems using various technologies and tools

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1			**2**	**2**	
CO2	**2**			**2**	
CO3	**2**			**2**	
CO4	**2**			**2**	

List of Lab Tasks

Task 1: Configure apache hadoop environment: To understand distributed and parallel computing environment

Task 2: Hadoop file management: Adding files and directories ,Retrieving files , Deleting files

Task 3: Word Count application: MapReduce program to understand MapReduce

Paradigm

Task 4: Semi structured data: Mapreduce program that mines a given semi structured dataset (weather data.)

Task 5: Graph Mining: Use MapReduce to find the shortest path between two people in a social graph.

Task 6: NO-SQL database –Apcache Hbase: To set Hbase shell environment and to create tables, insert rows, display contents etc

Task 7: Pig Latin scripts : To sort, group, join for a given dataset

Task 8: Database manipulation using Hive: To create, alter, drop databases and views

Task 9: Functions and indexes in Hive

Task 10: Use Hive to Drop Functions and indexes

Additional Experiment:

To practice data extraction, transformation and load techniques (ETL)

15CSCS 2052
IoT: INTERNET OF THINGS LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	3-0-0
Course Type:	Practical	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the IoT Architecture and its major components.
CO2	Analyze the appropriate Microcontroller Architecture for an IoT Application.
CO3	Develop IoT Application using IoT platforms.
CO4	Learn to manage the resources in IoT

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**1**				
CO2	**1**		**2**	**2**	
CO3	**1**		**2**	**2**	
CO4	**1**		**2**	**2**	

List of Lab Tasks

Phase 1: Experiment task based on 8051 Microcontroller

Task 1: Interfacing LCD controller with 8051µC

Task 2: Interfacing Stepper Motor with 8051 µC

Task 3: Program for Seven Segment Display

Task 4: Program for A/D and D/A Conversion

Phase 2: Experiment task based on Arduino Board Uno & Raspberry pi

Task 5: Interfacing DHT11 Humidity Sensor with Arduino Uno Board.

Task 6: Intruder Detection using PIR Motion sensor and Arduino Uno Board.

Task 7: Distance Measurement using Ultra Sonic Sensor (HC-SR04) and Arduino Uno Board.

Task 8: ESP8266 WI-FI Module Interface with Arduino control with Web server.

Task 9: ESP8266 WI-FI Module Interface with Arduino and DHT11 data upload to the cloud server.

Task 10: Voice – Activated Arduino Bluetooth Android.

Task 11: Configuring Raspberry pi and sensor interfacing

Task 12: Complete study on ARM Cortex processor.

Task 13: Installation of Nodejs on Raspberry Pi and simple Hello World Program

TEXT BOOKS

[1] Charalampos Doukas "Building Internet of Things With the Arduino", CreateSpace Independent Publishing Platform, 2012.

[2] Arshdeep Bahga , Vijay Madisetti "Internet of Things (A Hands-on-Approach)" 1st Edition VPI publishers, 2014.

[3] Milan Verle, "Architecture and Programming of 8051 Microcontrollers" 1st Edition mikro Elektronika (**eBook** Online) 2009.

[4] Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi" O'Reilly (SPD), 2014.

REFERENCE BOOKS

[1] Luigi Atzor et.al, "The Internet of Things: A survey", Journal on Networks, Elsevier Publications, October, 2010

[2] Web Link 1: http://postscapes.com/(Accessed on 16 February 2016).

[3] Web Link 2: http://www.theinternetofthings.eu/what-is-the-internet-of-

things(Accessed on 16 February 2016)

[4] Web Link 3:http://www.arm.com/products/processors/(Accessed on 16 February 2016)

[5] Web Link 4:https://www.arduino.cc/en/ArduinoCertified/IntelGalileo (Accessed on 16 February 2016)

[6] Web Link 5: http://www.libelium.com/top_50_iot_sensor_applications_ranking/(Accessed on 16 February 2016).

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Lecture Series on **"Introduction to Internet of Things"** by Prof. Raj Jain, Washington University, Available at:https://www.youtube.com/watch?v=oc_qzTj26k&list=PLw5h0DiJ9PCxDZkP8pbgpyiDweF3DJ8c (Accessed on 16 February 2016)

15CSCS2053
CLOUD COMPUTING LAB

Course Category:	Programme Core	**Lecture-Tutorial-Practice:**	0-0-3
Course Type:	Lab	**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the evolution of cloud computing paradigm and its architecture
CO2	Explain and characterize different cloud deployment models and service models
CO3	Identify the various technological drivers of cloud computing paradigm
CO4	Identify the security issues in cloud computing

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1			**2**		
CO2			**2**	**1**	
CO3			**3**	**2**	
CO4	**1**			**2**	

List of Lab Tasks

Task 1: Study about Google Apps and Microsoft Azure

Task 2: Building a simple cloud application using Google App Engine and

Microsoft Azure

Task 3: Hosting cloud application using Google App Engine or Microsoft Azure

Task 4: Implement Virtual OS using virtual box.

Task 5: Simulate VM allocation algorithm using CloudSim.

Task 6: Simulate Task scheduling algorithm using CloudSim.

Task 7: Simulate Energy-conscious mode using CloudSim.

Task 8: Setup a Private Cloud Using Open Stack or Eucalyptus.

Task 9: Install and configure Open Stack Object Storage - Swift in Ubuntu.

Task 10: Implement Open Stack Nova-Compute.

Task 11: Implement Open Stack Image services – Glance.

15CSCS2054
SEMINAR

Course Category:		**Lecture-Tutorial-Practice:**	0-0-0
Course Type:		**Continuous Evaluation:**	40
Credits:	2	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Identify emerging technologies on various domains
CO2	Analyze technologies on specific applications
CO3	Compare enhancements in the emerging technologies with existing technologies
CO4	Acquire the knowledge/ skills on various technologies
CO5	Express technical ideas strategies and methodologies in written form

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**2**			**1**	
CO2		**2**			
CO3	**3**				
CO4				**2**	
CO5		**3**			

SEMESTER III

15CSCS3051
PROJECT WORK – PART A

Course Category:		**Lecture-Tutorial-Practice:**	0-0-0
Course Type:		**Continuous Evaluation:**	40
Credits:	10	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Identify a real world problem in specific domain and its feasibility
CO2	Explore the existing technologies/ Methodologies
CO3	Apply the techniques for data preparation and formulization
CO4	Design a prototype
CO5	Prepare the technical Report
CO6	Prepare and conduct oral presentations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**2**		**2**	**1**	**1**
CO2	**2**		**2**	**1**	
CO3	**2**		**2**	**2**	
CO4	**2**		**2**	**2**	**1**
CO5		**2**			**1**
CO6		**2**			**1**

SEMESTER IV

15CSCS4051
PROJECT WORK – PART B

Course Category:		**Lecture-Tutorial-Practice:**	0-0-0
Course Type:		**Continuous Evaluation:**	40
Credits:	14	**Semester end Evaluation:**	60
Regulations	M. TECH-15	**Total Marks:**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Develop and implement proposed methodologies
CO2	Validate the methodology with the requirements of the problem
CO3	Compare proposed methodology with existing technologies to do performance analysis.
CO4	Prepare the quality technical Report with professional ethics
CO5	Prepare and conduct oral presentations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**2**		**2**	**2**	**2**
CO2	**3**		**3**	**3**	**1**
CO3	**3**		**3**	**3**	
CO4		**3**			**3**
CO5		**3**			