ACADEMIC REGULATIONS, COURSE STRUCTURE

and

DETAILED SYLLABUS

CHOICE BASED CREDIT SYSTEM

R21

M.Tech – Computer Science & Engg.

M.Tech - Regular Two Year Degree Programme

(For batches admitted from the academic year 2021 - 2022)

Holy Mary Institute of Technology & Science

Bogaram (V), Keesara (M), Medchal (Dist) - 501 301

FOREWORD

The autonomy is conferred on Holy Mary Institute of Technology & Science by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

Holy Mary Institute of Technology & Science is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a two decades in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college to order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

M. Tech. - Regular Two Year Degree Programme
(For batches admitted from the academic year 2021 - 22)

For pursuing two year post graduate Masters Degree Programme of study in Engineering (M.Tech) offered by Holy Mary Institute of Technology & Science under Autonomous status and herein referred to as HITS (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2021-22 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Holy Mary Institute of Technology & Science (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Holy Mary Institute of Technology & Science shall be the Chairman, Academic Council.

1. ADMISSION

Admission into first year of two year M. Tech. degree Program of study in Engineering:
Eligibility:

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt., From time to time.

The medium of instructions for the entire post graduate programme in Engineering & technology will be English only.

2. AWARD OF M. Tech. DEGREE

A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after two academic years of course work, failing which he shall forfeit his seat in M. Tech. programme.

The student shall register for all 68 credits and secure all the 68 credits.

The minimum instruction days in each semester are 90.

3. BRANCH OF STUDY

The following specializations are offered at present for the M. Tech programme of study.

1. Highway Engineering
2. CSE
3. Computer Networks & Information Security
4. Embedded Systems
5. VLSI Design
6. Electrical Power Systems
7. Power Electronics
8. CAD / CAM
9. Machine Design

4. COURSE REGISTRATION

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice / Option for Courses, based on his competence, progress, pre-requisites and interest.

4.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work, ensuring 'DATE and TIME Stamping'. The Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

4.3 A Student can apply Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries - during Registration for the Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.

4.5 Course Registrations are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new course (subject to offering of such a course), or for another existing course (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5. ATTENDANCE

The programmes are offered on a unit basis with each subject being considered a unit.

5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the End Semester examination. A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below75%) in each semester shall be granted by the College Academic Committee.

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end semester examination of that subject and their registration shall stand cancelled.

5.5 A prescribed fee shall be payable towards condonation of shortage of attendance.

5.6 A Candidate shall put in a minimum required attendance at least three (3) theory courses in I Year I semester for promoting to I Year II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the courses, as per the course structure.

5.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present Semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission in to the same class.

6. EVALUATION

The performance of the candidate in each semester shall be evaluated course-wise, with a maximum of 100 marks for theory and 100 marks for practical's, on the basis of Internal Evaluation and End Semester Examination.

- For the theory courses 70 marks shall be awarded for the performance in the Semester End Examination and 30 marks shall be awarded for Continuous Internal Evaluation (CIE). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other, immediately after the completion of Semester instructions. Each mid-term examination shall be conducted for a total duration of 120 minutes.

Continuous Internal Examination (CIE)

- Subjective Paper shall contain three questions. Question 1 & 2 with internal choice from unit-I, question 3 & 4 with internal choice from unit-II and question no 5 & 6 may be having a, b sub questions with internal choice from first half part of unit-III for CIE-I. For CIE-II 1 & 2 questions from unit-4, questions 3 & 4 from unit-5 and question no 5 & 6 from remaining half part of unit-3. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. Question no. 1 to 6 carries 10 Marks.

Semester End Examination (SEE)

- The Semester End Examination will be conducted for 70 marks examination shall be conducted for a total duration of 180 minutes. Question paper consists of Part–A and Part-B with the following.
- Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 4 marks each.
- Part-B to be answered 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.

6.1 For practical courses, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded for day-to-day performance as Internal Marks.

6.2 For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Chief Controller of Examination in one week before for commencement of the lab end examinations.

6.3 There shall be a seminar presentations during II year I semester. 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 Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

6.4 A candidate shall be deemed to have secured the minimum academic requirement in a Course if he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

6.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 6.6) he has to re appear for the Semester End Examination in that course.

6.6 A candidate shall be given one chance to re-register for the courses if the internal marks secured by a candidate is less than 50% and failed in that course for maximum of two courses and should register within four weeks of commencement of the class work. In such a case, the candidate must re-register for the courses and secure the required minimum attendance. The candidate's attendance in the re-registered course(s) shall be calculated separately to decide upon his eligibility for writing the Semester End Examination in those courses. In the event of the student taking another chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stands cancelled.

6.7 In case the candidate secures less than the required attendance in any course, he shall not be permitted to write the Semester End Examination in that course. He shall re-register for the course when next offered.

6.8 Offering one open elective courses in III-Semester along with core and specialized courses as a part of inculcating knowledge to the student.

7. EXAMINATIONS AND ASSESSMENT - THE GRADING SYSTEM

7.1 Marks will be awarded to indicate the performance of each student in each Theory Course, or Lab/Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item6above, and a corresponding Letter Grade shall be given.

7.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points*
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (above Average)	6
Below 50% (< 50%)	F (FAIL)	0
Absent	AB	0

7.3 A student obtaining F Grade in any Course shall be considered 'failed' and is be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Courses will remain the same as those he obtained earlier.

7.4 A student not appeared for examination then 'AB' Grade will be allocated in any Course shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

7.6 In general, a student shall not be permitted to repeat any Course(s) only for the sake of 'Grade Improvement' or 'SGPA / CGPA Improvement'.

7.7 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course. The corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject / Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

7.8 The Student passes the Course only when he **gets GP >=6 (B Grade or above).**

7.9 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

7.10 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP)secured from ALL Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = $\{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$ …. For each Semester,

where 'i' is the Course indicator index (takes into account all Courses in a Semester), 'N' is the no. of Courses 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to that ix Course, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that its Course.

Illustration of Computation of SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	3	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x10= 30
Course5	3	C	5	3 x 5 = 15
Course6	3	B	6	4 x 6 = 24

Thus, **SGPA =139/18 =7.72**

7.11 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

CGPA = $\{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \}$ … for all S Semesters registered

(i.e., up to and inclusive of S Semesters, S ≥ 2)

where 'M' is the TOTAL no. of Courses (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Course indicator index (takes into account all Courses from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Course, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Course. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4
Credits : 18 SGPA : 7.72	Credits : 18 SGPA : 7.8	Credits : 12 SGPA : 5.6	Credits : 20 SGPA : 6.0

Thus, **CGPA =** $\dfrac{18 \times 7.72 + 18 \times 7.8 + 12 \times 5.6 + 20 \times 6.0}{68} = 6.86$

7.12 For Calculations listed in Item 7.6 – 7.10, performance in failed Courses (securing F Grade) will also be taken into account, and the Credits of such Courses will also be included in the multiplications and summations.

7.13 No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given semester.

7.14 Conversion formula for the conversion of GPA into indicative percentage is

% of marks scored = (final CGPA -0.50) x 10

8. EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of three months between them.

8.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 30%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.

8.9 For Dissertation Phase-I in II Year I Sem. there is an internal marks of 100, the evaluation should be done by the PRC for 50 marks and Supervisor will evaluate for 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Phase-I. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.

8.10 For Dissertation Phase-II (Viva Voce) in II Year II Sem. There is an internal marks of 50, the evaluation should be done by the PRC for 25 marks and Supervisor will evaluate for 25 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. There is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations and he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

8.11 If he fails to fulfill as specified in 8.10, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill, he will not be eligible for the award of the degree.

8.12 The thesis shall be adjudicated by one examiner selected by the Chief Controller of Examinations. For this, the HOD of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned and Head of the Department.

8.13 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

8.14 If the report of the examiner is favorable, Project dissertation shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.

8.15 The Head of the Department shall coordinate and make arrangements for the conduct of Project dissertation.

8.16 For Audit Course (Non-Credit Courses) offered in a Semester, after securing ≥ 65% attendance and has secured not less than 40% marks in the SEE, and a minimum of 50% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for these courses/activities. However, for non-credit courses '**SATISFACTORY'** or "**UNSATISFACTORY'** shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9. AWARD OF DEGREE AND CLASS

9.1 A Student who registers for all the specified Courses/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of 68 Credits (with CGPA ≥ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 **Award of Class**

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 7.00 to < 8.00 CGPA
Second Class	≥ 6.00 to < 7.00 CGPA

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10. WITHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be with held in such cases.

11. TRANSITORY REGULATIONS

11.1 If any candidate is detained due to shortage of attendance in one or more courses, they are eligible for re-registration to maximum of two earlier or equivalent courses at a time as and when offered.

11.2 The candidate who fails in any course will be given two chances to pass the same course; otherwise, he has to identify an equivalent course as per HITS21 Academic Regulations.

12 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd semester shall be conducted with the regular examinations of even semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write more than one examination.

13. REVALUATION

Students shall be permitted for revaluation after the declaration of end semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

14. AMENDMENTS TO REGULATIONS

The Academic Council of Holy Mary Institute of Technology & Science reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

15. GENERAL

15.1 **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

15.2 **Credit Point:** It is the product of grade point and number of credits for a course.

15.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”.

15.4 The academic regulation should be read as a whole for the purpose of any interpretation.

15.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices / Improper Conduct	Punishment
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the

		course by the candidate is course to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

COURSE STRUCTURE

Dept. of M.Tech – Computer Science & Engineering

I M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1CS101PC	Advanced Data Structures	PC	3	-	-	3	30	70	100
B1CS102PC	Mathematical Foundations of Computer Science	PC	3	-	-	3	30	70	100
B1CS103PC	Machine Learning	PC	3	-	-	3	30	70	100
	Professional Elective-I	PE	3	-	-	3	30	70	100
	Professional Elective-II	PE	3	-	-	3	30	70	100
B1CS104PC	Advanced Data StructuresLab	PC	-	-	3	1.5	30	70	100
B1CS105PC	Machine Learning Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Audit Course (Non-Credit)									
	Audit Course – I	AC	2	-	-	-	100	-	100

I M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1CS201PC	Advanced Algorithms	PC	3	-	-	3	30	70	100
B1CS202PC	Big Data Engineering	PC	3	-	-	3	30	70	100
B1CS203PC	Advanced Computer Networks	PC	3	-	-	3	30	70	100
	Professional Elective-III	PE	3	-	-	3	30	70	100
	Professional Elective-IV	PE	3	-	-	3	30	70	100
B1CS204PC	Advanced Algorithms Lab	PC	-	-	3	1.5	30	70	100
B1CS205PC	Big Data Engineering Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Audit Course (Non-Credit)									
	Audit Course – II	AC	2	-	-	-	100	-	100

II M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
	Professional Elective-V	PE	3	-	-	3	30	70	100
	Open Elective	OE	3	-	-	3	30	70	100
B1CS301PC	Technical Seminar	PC	2	-	-	2	100	-	100
B1CS302PW	Dissertation Phase-I	PWC	-	-	16	8	100	-	100
TOTAL			**8**	**-**	**16**	**16**	**260**	**140**	**400**

II M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1CS401PW	Dissertation Phase - II	PWC	-	-	32	16	50	150	200
TOTAL			**-**	**-**	**32**	**16**	50	150	**200**

PROFESSIONAL ELECTIVES			
PE-I			**PE-II**
B1CS101PE	Information Security	B1CS104PE	Distributed Database
B1CS102PE	Advanced Artificial Intelligence	B1CS105PE	Cloud Computing
B1CS103PE	Internet of Things	B1CS106PE	Data Mining
PE-III		**PE-IV**	
B1CS207PE	Computer Vision	B1CS210PE	Deep Learning
B1CS208PE	Soft Computing	B1CS211PE	Parallel Computing
B1CS209PE	Block Chain Technologies	B1CS212PE	Digital Forensics
PE-V			
B1CS313PE	Social Media Mining		
B1CS314PE	Advanced Operating Systems		
B1CS315PE	Reinforcement Learning		

OPEN ELECTIVES	
B1CS301OE	Software Project Management
B1CS302OE	Internet of Things
B1CS303OE	Adhoc & Sensor Networks
B1CS304OE	Information Retrieval Systems

AUDIT COURSE I		AUDIT COURSE II	
B1CS101AC	English for Research Paper Writing	B1CS203AC	Disaster Management
B1CS102AC	Research Methodology and IPR	B1CS204AC	Personality Development Through Life Enlightenment Skills

DETAILED SYLLABUS

I-YEAR (I-SEMESTER)

ADVANCED DATA STRUCTURES

I M.Tech I Semester **L T P C**
Course Code: B1CS101PC **3 - - 3**

COURSE OBJECTIVES:

The student should be able to

1. Choose appropriate data structures, understand the ADT/libraries, and use it to designalgorithms for a specific problem.
2. Understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Come up with analysis of efficiency and proofs of correctness.

COURSE OUTCOMES:

Understand the implementation of symbol table using hashing techniques.

1. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
2. Develop algorithms for text processing applications.
3. Identify suitable data structures and develop algorithms for computational geometry problems
4. Implement the concepts of trees in various applications.

UNIT- I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT- II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT- III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT- IV

Text Processing: Sting Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT – V

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

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

REFERENCE BOOKS:

1. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and D.Mount, Sevent Edition Wiley student edition, John Wiley and Sons.
2. Data Structures and Algorithms in C++, Third Edition, Adam Drozdek, Thomson
3. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.
4. C++, The Complete Reference, 4th Edition, Herbert Schildt, TMH.
5. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI/PearsonEducation.

MATHEMATICAL FOUNDATIONS AND COMPUTER SCIENCE

I M.Tech I Semester **L T P C**
Course Code: B1CS102PC **3 - - 3**

COURSE OBJECTIVES:

1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software
2. Engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
3. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
4. To study various sampling and classification problems.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. To understand the basic notions of discrete and continuous probability.
2. To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
3. To be able to perform correct and meaningful statistical analyses of simple to moderate Complexity.

UNIT - I

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

UNIT - II

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood,

UNIT- III

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment

UNIT- IV

Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve
combinatorial enumeration problems

UNIT - V

Computer science and engineering applications Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning. Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bio-informatics, soft computing, and computer vision.

TEXT BOOKS:

1. John Vince, Foundation Mathematics for Computer Science, Springer.

REFERENCE BOOKS:

1. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
2. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
3. Alan Tucker, Applied Combinatorics, Wiley

MACHINE LEARNING

I M.Tech I Semester **L T P C**
Course Code: B1CS103PC **3 - - 3**

COURSE OBJECTIVES:

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Extract features that can be used for a particular machine learning approach in various IOT applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyse various machine learning approaches and paradigms.

UNIT – I

Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes.

Linear models: Linear Regression, Logistic Regression, Generalized Linear Models. Support Vector Machines, Nonlinearity and Kernel Methods.

Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

UNIT - II

Unsupervised Learning: Clustering: K-means/Kernel K-means. Dimensionality Reduction: PCA and kernel PCA. Matrix Factorization and Matrix Completion. Generative Models (mixture models and latent factor models).

UNIT- III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT- IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

UNIT - V

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

REFERENCE BOOKS:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

INFORMATION SECURITY
(PROFESSIONAL ELECTIVE - I)

I M.Tech I Semester **L T P C**

Course Code: B1CS101PE **3 - - 3**

COURSE OBJECTIVES:

1. To understand the fundamentals of Cryptography
2. To understand various key distribution and management schemes
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To apply algorithms used for secure transactions in real world applications

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Demonstrate the knowledge of cryptography, network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

UNIT - I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.

Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

UNIT - II

Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT - III

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service.

Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT - IV

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT - V

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXT BOOKS

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

REFERENCE BOOKS

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

ADVANCED ARTIFICIAL INTELLIGENCE
(PROFESSIONAL ELECTIVE - I)

I M.Tech I Semester **L T P C**

Course Code: B1CS102PE **3 - - 3**

COURSE OBJECTIVES:

1. To learn the difference between optimal reasoning Vs human like reasoning
2. To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
3. To learn different knowledge representation techniques
4. To understand the applications of AI: namely Game Playing, Theorem Proving, Expert
5. Systems, Machine Learning and Natural Language Processing

UNIT-I

Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies

UNIT-II

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic,
forward and Backward Chaining

UNIT-III

Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks

UNIT-IV

Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

UNIT-V

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools

TEXT BOOKS:

1. Stuart Russell, Peter Norvig: “Artificial Intelligence: A Modern Approach”,2nd Edition, Pearson Education, 2007

REFERENCE BOOKS:

1. Artificial Neural Networks B. Yagna Narayana, PHI
2. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
3. Artificial Intelligence and Expert Systems – Patterson PHI.
4. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
5. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
6. Neural Networks Simon Haykin PHI

INTERNET OF THINGS
(PROFESSIONAL ELECTIVE – I)

I M.Tech I Semester **L T P C**
Course Code: B1CS103PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. To understand the fundamentals of Internet of Things.
2. To learn about the basics of IOT protocols.
3. To build a small low cost embedded system using Raspberry Pi and Adriano board.
4. To apply the concept of Internet of Things in the real world scenario.

COURSE OUTCOMES:

1. Able to understand the application areas of IOT
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics.
4. To classify Real World IoT Design Constraints, Industrial Automation in IoT.

UNIT - I

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT - II

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT - III

IOT Protocols & Building IOT with Arduino: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.
Introduction to microcontroller and microprocessor, Arduino Board Layout and architecture, Programming with Arduino IDE, Reading data from analog or digital sensors, writing data to analog PWM or Digital actuators.

UNIT - IV

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python.

UNIT - V

Case Studies and Real – World Applications Functions: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖,UniversitiesPress, 2015.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖,UniversitiesPress, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRCPress, 2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.
6. B. A. Forouzan, R. F. Gillberg, “C Programming and Data Structures”, Cengage Learning, India, 3rd Edition, 2014.

WEB REFERENCES:

1. https://wso2.com/whitepapers/a-reference-architecture-for-the-internet-of-things/
2. http://www.ti.com/ww/en/internet_of_things/iot-applications.html

E-TEXT BOOKS:

1. https://cloud.oracle.com/en_US/opc/iot/ebooks
2. https://www.vitalsource.com/en-uk/products/analytics-for-the-internet-of-things-iot-andrew-minteer-v9781787127579

DISTRIBUTED DATABASE
(PROFESSIONAL ELECTIVE – II)

I M.Tech I Semester **L T P C**

Course Code: B1CS104PE **3 - - 3**

COURSE OBJECTIVES:

1. To understand the theoretical and practical aspects of the database technologies.
2. To understand the need for distributed database technology to tackle deficiencies of the centralized database systems.
3. To introduce the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Identify the introductory distributed database concepts and its structures.
2. Describe terms related to distributed object database design and management.
3. Produce the transaction management and query processing techniques in DDBMS.
4. Relate the importance and application of emerging database technology

UNIT-I: INTRODUCTION

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design.

UNIT-II: QUERY PROCESSING

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries. Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

UNIT-III: TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL

The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT-IV: RELIABILITY AND SECURITY IN THE DISTRIBUTED DATABASES

Reliability, Basic Concepts, Non-blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection

UNIT-V: DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS

Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects

TEXT BOOKS:

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia Database System Concepts; Korth & Sudarshan; TMH
3. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall.

REFERENCE BOOKS:

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin C Desai; Galgotia

WEB REFERENCES:

1. https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm
2. https://www.geeksforgeeks.org/distributed-database-system/

E-TEXT BOOKS:

1. https://biblio.com.au/distributed-databases-by-ceri-stefano-pelagatti/work/245682
2. https://www.amazon.in/Distributed-Database-Systems-Chhanda-Ray-ebook/dp/B009NEMZ0W

MOOCS COURSE:

1. https://nptel.ac.in/syllabus/106106107/
2. https://www.coursera.org/learn/distributed-database

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE-II)

I M.Tech I Semester **L T P C**

Course Code: B1CS105PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. The student will also learn how to apply trust-based security model to real-world security problems.
2. An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
3. Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Identify security aspects of each cloud model
2. Develop a risk-management strategy for moving to the Cloud
3. Implement a public cloud instance using a public cloud service provider
4. Apply trust-based security model to different layer.

UNIT - I

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT - II

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model.

Cloud Deployment Models: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

UNIT-III

Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, the Host Level, the Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security.

Identity and Access Management: Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

UNIT-IV

Security Management in the Cloud Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

UNIT-V

Audit and Compliance Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud Advanced Topics Recent developments in hybrid cloud and cloud security.

REFERENCE BOOKS:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009.
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009.

DATA MINING
(PROFESSIONAL ELECTIVE-II)

I M.Tech I Semester **L T P C**

Course Code: B1CS106PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. To understand data mining concepts.
2. To learn about various data preprocessing techniques.
3. To learn about data warehousing.
4. To learn about various data mining functionalities such as association rule mining, clustering, classification and outlier analysis.

UNIT-I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Issues in Data Mining.

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT-II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Usage of Data Warehousing Online Analytical Processing and Mining.

Data Cube Computation: Efficient Methods for simple Data Cube Computation (Full Cube, Iceberg Cube, Closed Cube and Shell Cube), Discovery Driven exploration of data cubes, Attribute-Oriented Induction for data characterization and its implementation

UNIT-III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, The Apriori algorithm for finding frequent itemsets using candidate generation, Generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Mining various kinds of Association Rules, Correlation Analysis

UNIT-IV

Classification and Prediction: Description and comparison of classification and prediction, preparing data for Classification and Prediction Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation Prediction, linear and non-linear regression, evaluating accuracy of a Classifier or a Predictor

UNIT-V

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, kmeans and k-mediods methods, CLARANS, Agglomerative and divisive hierarchical clustering, chameleon dynamic modeling, DBSCAN, Grid based clustering method: STING, Conceptual Clustering, Constraint-Based Cluster Analysis, Outlier Analysis.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques - Jiawei Han, Micheline Kamber and Jian Pei, 3rd edition, Morgan Kaufmann Publishers, ELSEVIER.
1. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

REFERENCE BOOKS:

1. Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Edn Asia.
2. Insight into Data Mining, K. P. Soman, S. Diwakar, V. Ajay, PHI, 2008.
3. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition
4. The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley student edition
5. Building the Data Warehouse By William H Inmon, John Wiley & Sons Inc, 2005.
6. Data Mining Introductory and advanced topics –Margaret H Dunham, Pearson education
7. Data Mining Techniques – Arun K Pujari, 2nd edition, Universities Press.
8. Data Mining, V. Pudi and P. Radha Krishna, Oxford University Press.
9. Data Mining: Methods and Techniques, A.B. M Shawkat Ali and S. A. Wasimi, Cengage Learning.
10. Data Warehouse 2.0, The Architecture for the next generation of Data Warehousing, W.H. Inmon, D. Strauss, G. Neushloss, Elsevier, Distributed by SPD.

ADVANCED DATA STRUCTURES LAB

I M.Tech I Semester **L T P C**

Course Code: B1CS104PC **- - 3 1.5**

COURSE OBJECTIVES:

The course should enable the students to:

1. Introduces the basic concepts of Abstract Data Types.
2. Reviews basic data structures such as stacks and queues.
3. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
4. Introduces sorting and pattern matching algorithms

COURSE OUTCOMES:

After the successful completion of the course student will be able to:

1. Ability to select the data structures that efficiently model the information in a problem.
2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.
3. Implement and know the application of algorithms for sorting and pattern matching.
4. Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees

LIST OF EXPERIMENTS

WEEK- 1

Write a program to perform the following operations:

a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.

WEEK- 2

Write a program for implementing the following sorting methods:

a) Merge sort
b) Heap sort
c) Quick sort

WEEK- 3

Write a program to perform the following operations:

a) Insert an element into a B- tree.
b) Delete an element from a B- tree.
c) Search for a key element in a B- tree.

WEEK- 4

Write a program to perform the following operations:

a) Insert an element into a Min-Max heap
b) Delete an element from a Min-Max heap
c) Search for a key element in a Min-Max heap

WEEK- 5

Write a program to perform the following operations:

a) Insert an element into a Lefiist tree
b) Delete an element from a Leftist tree
c) Search for a key element in a Leftist tree

WEEK- 6

Write a program to perform the following operations:

a) Insert an element into a binomial heap
b) Delete an element from a binomial heap.
c) Search for a key element in a binomial heap

WEEK- 7

Write a program to perform the following operations:

a) Insert an element into a AVL tree.
b) Delete an element from a AVL search tree.
c) Search for a key element in a AVL search tree.

WEEK- 8

Write a program to perform the following operations:

a) Insert an element into a Red-Black tree.
b) Delete an element from a Red-Black tree.
c) Search for a key element in a Red-Black tree.

WEEK- 9

Write a program to implement all the functions of a dictionary using hashing.

Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.

WEEK- 10

Write a program for implementing Brute Force pattern matching algorithm.

Write a program for implementing Boyer pattern matching algorithm.

MACHINE LEARNING LAB

I M.Tech I Semester **L T P C**

Course Code: B1CS105PC **- - 3 1.5**

COURSE OBJECTIVES:

1. The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python

COURSE OUTCOMES:

Student who successfully completes this course should be able to

1. Understand complexity of Machine Learning algorithms and their limitations;
2. Understand modern notions in data analysis-oriented computing;
3. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own; Be capable of performing experiments in Machine Learning using real-world data.

LIST OF EXPERIMENTS

WEEK-1

The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)

WEEK-2

Extract the data from database using python.

WEEK-3

Implement k-nearest neighbors classification using python.

WEEK-4

Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1 VAR2 CLASS
1.713 1.586 0
0.180 1.786 1
0.353 1.240 1
0.940 1.566 0
1.486 0.759 1
1.266 1.106 0
1.540 0.419 1
0.459 1.799 1
0.773 0.186 1

WEEK-5

The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

Medium skiing design single twenties no -> high Risk
High golf trading married forties yes -> low Risk
Low speedway transport married thirties yes -> med Risk
Medium football banking single thirties yes -> low Risk
High flying media married fifties yes -> high Risk

Low football security single twenties no -> med Risk
Medium golf media single thirties yes -> med Risk
Medium golf transport married forties yes -> low Risk
High skiing banking single thirties yes -> high Risk
Low golf unemployed married forties yes -> high Risk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?

WEEK-6

Implement linear regression using python.

WEEK-7

Implement Naïve Bayes theorem to classify the English text.

WEEK-8

Implement an algorithm to demonstrate the significance of genetic algorithm

WEEK-9

Implement the finite words classification system using Back-propagation algorithm

ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE-I)

I M.Tech I Semester	L	T	P	C
Course Code: B1CS101AC	2	-	-	-

COURSE OBJECTIVES:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title.

UNIT - I

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

UNIT - II

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

UNIT - III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT - IV

Methods & Conclusions skills are needed when writing the Methods, skills needed when writing the Results, skills are neededwhen writing the Discussion, skills are needed when writing the Conclusions.

UNIT - V

Submissions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

SUGGESTED STUDIES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

RESEARCH METHODOLOGY AND IPR
(AUDIT COURSE-I)

I M.Tech I Semester **L T P C**

Course Code: B1CS102AC **2 - - -**

COURSE OUTCOMES:

The course should enable the students to:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT - I

Introduction to Research Methodology Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessaryinstrumentations

UNIT- II

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

UNIT- III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting andDevelopment: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

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

UNIT- V

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

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

REFERENCE BOOKS:

1. Mayall, “Industrial Design”, McGraw Hill, 1992.
2. Niebel, “Product Design”, McGraw Hill, 1974.
3. Asimov, “Introduction to Design”, Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New TechnologicalAge”, 2016.
5. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

WEB REFERENCES:

1. https://www.goodreads.com/book/show/761696.Research_Methodology
2. https://www.amazon.com/ResearchMethodology...WayneGoddard/dp/0702156
3. https https://www.goodreads.com/book/show/761695.Research_Methodology

E-TEXT BOOKS:

1. swelanphar.yolasite.com/.../Wayne-Goddard-Stuart-MelvilleResearchMethodology
2. shodhganga.inflibnet.ac.in/bitstream/10603/4644/10/10_chapter%204.pdf
3. https://archive.org/.../RanjitKumarResearchMethodologyAStepByStepG/Ranjit_Kumar.

MOOCS COURSE:

1. https://swayam.gov.in/course/292-introduction-to-research
2. https://www.openlearning.com/courses/SPPP3042x

I-YEAR (II-SEMESTER)

ADVANCED ALGORITHMS

I M.Tech II Semester **L T P C**

Course Code: B1CS201PC **3 - - 3**

COURSE OBJECTIVES:

1. Introduce students to the advanced methods of designing and analyzing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Students should have an insight of recent activities in the field of the advanced data structure.

UNIT - I

Sorting: Review of various sorting algorithms, topological sorting

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

UNIT - II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT - III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximumflow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT - IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

UNIT - V

Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest: Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm , Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

REFERENCE BOOKS:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

BIGDATA ENGINEERING

I M.Tech II Semester **L T P C**
Course Code: B1CS202PC **3 - - 3**

COURSE OBJECTIVES:

1. To understand about big data.
2. To learn the analytics of Big Data.
3. To Understand the MapReduce fundamentals.

UNIT - I

Big Data Analytics: What is big data, History of Data Management; Structuring Big Data; Elements of Big Data; Big Data Analytics; Distributed and Parallel Computing for Big Data; Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools;

UNIT - II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT - III

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFC Files, File system types, commands, org.apache.hadoop.io package, HDF, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS;

UNIT - IV

Big Data Technology Landscape and Hadoop: NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFC (Hadoop Distributed File System), HDFC Daemons, read, write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web
Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

TEXT BOOKS:

1. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. Big Data, Black BookTM, DreamTech Press, 2015 Edition.
3. Business Analytics 5th edition , BY Albright |Winston

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

ADVANCED COMPUTER NETWORKS

I M.Tech II Semester **L T P C**
Course Code: B1CS203PC **3 - - 3**

COURSE OBJECTIVES:

1. To review the computer networking concepts
2. To impart concepts of advanced computer networking.
3. To introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. To facilitate students in gaining expertise in some specific areas of networking such as the design and maintenance of individual networks.

COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Apply Data Communications System and its components.
2. Identify the different types of network topologies and protocols.
3. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
4. Identify the different types of network devices and their functions within a network

UNIT - I

Computer Networks and the Internet: History of Computer Networking and the Internet, Networking Devices, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones. Networking Models: 5-layer TCP/IP Model,
7-Layer OSI Model, Internet Protocols and Addressing, Equal- Sized Packets Model: ATM.

UNIT - II

Network Routing Routing and its concepts: Structure of a Router, Basic Router Configuration, Building a Routing Table, Static Routing, Dynamic Routing – Distance Vector Routing Protocol (RIPv1, RIPv2, EIGRP), Link State Routing Protocols (OSPF).

UNIT - III

LAN Switching: Switching and its concepts: Structure of a Switch, Basic Switch Configuration, Virtual LANs (VLANs), VLAN Trunking Protocol (VTP), Spanning Tree Protocol (STP), Inter-VLAN Routing.

UNIT - IV

Wide Area Networks (WANs): Introduction to WANs, Point-to-Point Protocol (PPP) concepts, Frame Relay concepts, Dynamic Host Configuration Protocol (DHCP), Network Address Translation (NAT), IPv6.

UNIT - V

Network Programming using Java: TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI) - Basic RMI Process, Implementation details - ClientServer Application.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, Fifth Edition, Pearson Education, 2012.
2. Network Fundamentals, Mark Dye, Pearson Education.

REFERENCE BOOKS:

1. Computer Networks: A Systems approach, Larry L. Peterson & Bruce S. Davie, Fifth edition, Elsevier, rp2012.
2. Computer Networks: A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharaf, TataMcGraw Hill, 2012.
3. Java Network Programming,3rd edition, E.R. Harold, SPD, O"Reilly.(Unit V)

COMPUTER VISION
(PROFESSIONAL ELECTIVE-III)

I M.Tech II Semester **L T P C**

Course Code: B1CS207PE **3 - - 3**

COURSE OBJECTIVES:

1. To study the development of algorithms and techniques to analyze and interpret the visible worldaround us.
2. Be familiar with both the theoretical and practical aspects of computing with images.
3. To understand the basic concepts of Computer Vision.
4. Understand the geometric relationships between 2D images and the 3D world.
5. Ability to apply the various concepts of Computer Vision in other application areas.

COURSE OUTCOMES:

1. Understand the fundamental problems of computer vision.
2. Implement various techniques and algorithms used in computer vision.
3. Analyze and evaluate critically the building and integration of computer vision algorithms.
4. Demonstrate awareness of the current key research issues in computer vision

UNIT-I: DIGITAL IMAGE FORMATION AND LOW-LEVEL PROCESSING

Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing

UNIT-II: DEPTH ESTIMATION AND MULTI-CAMERA VIEWS

Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT-III: IMAGE SEGMENTATION

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT-IV: MOTION ANALYSIS

Motion Analysis: Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

UNIT-V: SHAPE FROM X

Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; PhotometricStereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Applications: CBIR, CBVR, activity recognition, computational photography, biometrics, stitching and document processing. Recent Trends: 3-D Printing, 3-D sensing, simultaneous location and mapping, GPU, edge-computing, augmented reality, virtual reality cognitive models, fusion and super resolution.

TEXT BOOKS:

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer-Verlag.

REFERENCE BOOKS:

1. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Pearson Education.
2. Multiple View Geometry in Computer Vision by Richard Hartley and Andrew Zisserman, Cambridge University Press.
3. Introduction to Statistical Pattern Recognition by K. Fukunaga, Academic Press, Morgan Kaufmann.
4. Digital Image Processing by R.C. Gonzalez and R.E. Woods, PHI.

SOFT COMPUTING
(PROFESSIONAL ELECTIVE-III)

I M.Tech II Semester **L T P C**

Course Code: B1CS208PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

The student should be made to

1. Learn the various soft computing frame works
2. Be familiar with design of various neural networks
3. Be exposed to fuzzy logic
4. Learn genetic programming.

COURSE OUTCOMES

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

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

UNIT - I

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets – crisp relations and fuzzy relations: cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.

UNIT- II

Neural Networks McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

UNIT-III

Fuzzy Logic Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals – fuzzy rule base.

Approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT- V

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

UNIT - V

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

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI /Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCE BOOKS:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications"Prentice Hall, 1997.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, andProgramming Techniques, Pearson Education India, 1991.

BLOCK CHAIN TECHNOLOGIES
(PROFESSIONAL ELECTIVE-III)

I M.Tech II Semester **L T P C**

Course Code: B1CS209PE **3 - - 3**

COURSEOBJECTIVES:

The course should enable the students to:

1. To Introduce block chain technology and Crypto currency

COURSEOUTCOMES:

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

1. Learn about research advances related to one of the most popular technological areas today.

UNIT–I

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowd funding.

UNIT–II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

UNIT–III

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

UNIT–IV

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

UNIT–V

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

TEXT BOOKS:

1. Blockchain Blue prints for Economy by Melanie Swan

REFERENCE BOOKS:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher

DEEP LEARNING
(PROFESSIONAL ELECTIVE-IV)

I M.Tech II Semester	L T P C
Course Code: B1CS210PE	3 - - 3

COURSE OBJECTIVES:

The course should enable the students to learn:

This course covers the basics of machine learning, neural networks and deep learning. Model for deep learning technique and the various optimization and generalization mechanisms are included. Major topics in deep learning and dimensionality reduction techniques are covered. The objective of this course is:

1. To present the mathematical, statistical and computational challenges of building neural networks
2. To study the concepts of deep learning
3. To introduce dimensionality reduction techniques
4. To enable the students to know deep learning techniques to support real-time applications
5. To examine the case studies of deep learning techniques

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Understand basics of deep learning
2. Implement various deep learning models
3. Realign high dimensional data using reduction techniques
4. Analyze optimization and generalization in deep learning
5. Explore the deep learning applications

UNIT – I INTRODUCTION

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT – II DEEP NETWORKS

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow NetworksConvolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

UNIT – III DIMENSIONALITY REDUCTION

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT – IV OPTIMIZATION AND GENERALIZATION

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT – V CASE STUDY AND APPLICATIONS

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint DetectionBioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

TEXT BOOKS:

1. Deep Learning (Adaptive Computation and Machine Learning Series) by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016.

REFERENCE BOOKS:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

PARALELL COMPUTING
(PROFESSIONAL ELECTIVE-IV)

I M.Tech II Semester **L T P C**

Course Code: B1CS211PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

The student should be made to

1. To familiarize the issues in parallel computing.
2. To guide students in learning distributed memory programming using MPI.
3. To teach shared memory paradigm with Pthreads and with OpenMP.
4. To facilitate student in learning the GPU based parallel programming using OpenCL.

COURSE OUTCOMES:

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

1. Identify issues in parallel programming.
2. Develop distributed memory programs using MPI framework.
3. Design and develop shared memory parallel programs using Pthreads and using OpenMP.

Implement Graphical Processing OpenCL programs. Analyze various parallel programmingmodels with respect to performance and concurrency.

UNIT - I

Foundations of Parallel Programming: Motivation for parallel programming – Need- Concurrency in computing – Basics of processes, multitasking and threads – cache – cache mappings – caches and programs – virtual memory – Instruction level parallelism – hardware multi-threading – Parallel Hardware-SIMD – MIMD – Interconnection networks – cache coherence –Issues in shared memory model and distributed memory model – Parallel Software- Caveats- coordinating processes/ threads- hybrid model – shared memory model and distributed memory model - I/O – performance of
parallel programs-– parallel program design.

UNIT - II

Distributed Memory Programming with MPI: Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD programs– MPI_Send and MPI_Recv – message matching MPI- I/O – parallel I/O – collective communication – Tree-structured communication -MPI_Reduce –MPI_Allreduce, broadcast, scatter, gather, allgather – MPI derived types – dynamic process management performance evaluation of MPI programs- A Parallel Sorting Algorithm.

UNIT - III

Shared Memory Paradigm with Pthreads: Basics of threads, Pthreads – thread synchronization – critical sections – busy waiting – mutex – semaphores – barriers and condition variables – read write locks with examples - Caches, cachecoherence and false sharing – Thread safety-Pthreads case study.

UNIT - IV

Shared Memory Paradigm OpenMP: Basics OpenMP – Trapezoidal Rule-scope of variables – reduction clause – parallel for directive – loops in OpenMP – scheduling loops –Producer Consumer problem – cache issues – threads safety inOpenMP – Two- body solvers- Tree Search

UNIT - V

Hybrid Soft Computing Techniques & Applications, Graphical Processing Paradigms: OpenCL and Introduction to CUDA 9 Introduction to OpenCL – Example-OpenCL Platforms- Devices-Contexts - OpenCL programming – Built-In Functions-Programs Object and Kernel Object – Memory Objects - Buffers and Images – Event model – Command-Queue - Event Object - case study. Introduction to CUDA programming.

TEXT BOOKS:

1. A. Munshi, B. Gaster, T. G. Mattson, J. Fung, and D. Ginsburg, ―OpenCL programming guide‖,Addison Wesley
2. M. J. Quinn, ―Parallel programming in C with MPI and OpenMP, Tata McGraw Hill.

REFERENCE BOOKS:

1. Peter S. Pacheco, ―An introduction to parallel programming‖, Morgan Kaufmann.
2. Rob Farber, ―CUDA application design and development‖, Morgan Haufman.
3. W. Gropp, E. Lusk, and A. Skjellum, ―Using MPI: Portable parallel programming with the message passing interface‖, Second Edition, MIT Press.

DIGITAL FORENSICS
(PROFESSIONAL ELECTIVE-IV)

I M.Tech II Semester **L T P C**

Course Code: B1CS212PE **3 - - 3**

COURSE OBJECTIVES:

The student should be made to:

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

COURSE OUTCOMES:

The students will be able to:

1. Understand and correlate the network concepts with various layered security protocols
2. Defining various stages of Digital Forensics
3. Perform evidence collection ensuring its legal validity
4. Build and analyse the forensic reports from various tools

UNIT – I DIGITAL FORENSICS SCIENCE

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

UNIT – II CYBER CRIME SCENE ANALYSIS

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

UNIT – III EVIDENCE MANAGEMENT & PRESENTATION

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

UNIT – IV COMPUTER FORENSICS

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

UNIT – V COMPUTER FORENSICS

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

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

ADVANCE ALGORITHMS LAB

I M.Tech II Semester **L T P C**

Course Code: B1CS204PC **- - 3 1.5**

COURSE OBJECTIVES:

The course should enable the students to:
The student can able to attain knowledge in advance algorithms.

COURSE OUTCOMES:

After the completion of the "Machine Learning" lab, the student can able to:
The student can able to analyze the performance of algorithms.

LIST OF EXPERIMENTS

1. Implement assignment problem using Brute Force method
2. Perform multiplication of long integers using divide and conquer method.
3. Implement solution for knapsack problem using Greedy method.
4. Implement Gaussian elimination method.
5. Implement LU decomposition
6. Implement Warshall algorithm
7. Implement Rabin Karp algorithm.
8. Implement KMP algorithm.
9. Implement Harspool algorithm
10. Implement max-flow problem.

TEXT BOOKS:

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

REFERENCE BOOKS:

1. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein,PHI Pvt. Ltd./ Pearson Education.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education

BIGDATA ENGINEERING LAB

I M.Tech II Semester **L T P C**

Course Code: B1CS205PC **- - 3 1.5**

COURSE OBJECTIVES:

1. To familiarize students, about the concepts of Big Data and Big Data processing tools.
2. To facilitate students in learning HADOOP framework.
3. To teach and guide students in setting up cluster and help them in designing Big Data applications.

COURSE OUTCOMES:

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

1. Identify and list various Big Data concepts, tools and applications.
2. Develop programs using HADOOP framework.
3. Use Hadoop Cluster to deploy Map Reduce jobs, PIG and HIVE programs.
4. Analyze the given data set and identify deep insights from the data set

LIST OF EXPERIMENTS

WEEK-1

Basic Linux Commands.
Understanding how to connect to remote Linux server using putty kind of tool.

WEEK-2

Understanding VMware Player setup and configuring Cloudera Bundle using player.Basic HDFScommands.

WEEK-3

HDFS commands in detail. Hadoop File System navigation and manipulation using commands. FilePermission commands.

WEEK-4

Map Reduce Job submission to Hadoop Cluster from command line. Word Count Map Reduce JobDevelopment using eclipse IDE, packing and testing.

WEEK-5

Understanding weather dataset. Map Reduce Job to process weather datasets of different years.

WEEK-6

Using pig grunt shells. Practicing pig commands from grunt shell. Working with pig in interactive mode.Writing pig scripts and running them.

WEEK-7

Processing different datasets using Pig. Working with Various data formats using inbuilt Jars.

WEEK-8

Hive shell. Writing basic Hive queries. Hive DDL and DML.

WEEK-9

Using Hive to perform CRUD operations – Databases, Tables, Views, functions and indexes.

WEEK- 10

Working with Sqoop commands to import and export data between HDFS and RDBMS.
Working withSqoop to import data directly into hive tables.

WEEK-11

Working with Flume to ingest data from webserver logs or Social Media site like twitter.

TEXT BOOKS:

1. Hadoop Definitive Guide – 4th Editions, O'REILLY publications.
2. Big Data, Black Book: Dreamtech publications

DISASTER MANAGEMENT
(AUDIT COURSE-II)

I M.Tech II Semester **L T P C**

Course Code: B1CS201AC **2 - - -**

COURSE OUTCOMES:

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction andhumanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice frommultiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

UNIT - I

Introduction Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural andManmade Disasters: Difference, Nature, Types and Magnitude.

UNIT – II

Repercussions of Disasters and Hazards Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts

UNIT- III

Disaster Prone Areas in India& Disaster Preparedness Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; EvaluationOf Risk: Application Of Remote Sensing,

UNIT- IV

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

UNIT - V

Disaster Mitigation Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. StructuralMitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

SUGGESTED STUDIES

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategiesNewRoyal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep publication Pvt. Ltd., New Delhi.

PERSONALITY DEVELOPMENT THROGH LIFE ENLIGHTMENT SKILLS
(AUDIT COURSE-II)

I M.Tech II Semester **L T P C**

Course Code: B1CS202AC **2 - - -**

PREREQUISITE: None

COURSE OBJECTIVES:

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

COURSE OUTCOMES: Students will be able to

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

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

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

II-YEAR (I-SEMESTER)

SOCIAL MEDIA MINING
(PROFESSIONAL ELECTIVE-V)

II M.Tech I Semester	**L T P C**
Course Code: : B1CS313PE	**3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand sources and limitations of web-based data
2. Process the collected data - primarily structured - using methods involving correlation, regression, and classification to derive insights about the sources and people who generated thatdata
3. Learn new methods in mining streaming data, web data, etc.,

COURSE OUTCOMES:

After completion of this course, you will be able to:

1. Utilize various Application Programming Interface (API) services to collect data from different social media sources such as YouTube, Twitter.
2. Apply ethical principles to the use of web and social media data
3. Analyze unstructured data - primarily textual comments - for sentiments expressed in them.
4. Use different tools for collecting, analyzing, and exploring social media data for research and development purposes.

UNIT - I

FUNDAMENTALS OF SOCIAL MEDIA : Key concepts of social media mining - Good data versus bad data - Understanding sentiments- Scherer's typology of emotions - Sentiment polarity - data and classification - Supervised social media mining - lexicon-based sentiment - Supervised social media mining - Naive Bayes classifiers - Unsupervised social media mining - Item Response Theory for text scaling - Social Computing Tasks - Importance of Nodes - Strengths of Ties - Influence Modeling.

UNIT - II

SOCIAL MEDIA DATA : The nature of social media data - Traditional versus nontraditional social data - Measurement and inferential challenges - Opinion mining made difficult - Sentiment and its measurement - Big Data - Human Sensor and Honest Signals - Quantitative approaches - Challenges.

UNIT - III

COMMUNITIES AND SOCIAL MEDIA: Types of Communities - Node-Centric Community Detection - Group-Centric Community Detection - Network-Centric Community Detection - Hierarchy Centric Community Detection.

UNIT - IV

PATTERNS AND CLASSIFICATION IN SOCIAL MEDIA :Pattern Evolution - A Naïve Approach to Studying Community Evolution - Community Evolution in Smoothly Evolving Networks - Segment-based Clustering with Evolving Networks - Classification with Network Data - Collective Classification - Community-based Learning.

UNIT - V

R FUNDAMENTALS: Introduction to R - Assignment and arithmetic basics - Functions - Arguments - Vectors, sequences, and combining vectors - Creating data frames and importing files - Visualization in R - Style and workflow.

CASE STUDY: MINING TWITTER DATA: Twitter API - Search and Extraction of Tweets, Retweets - Graph Visualization of Tweets, Retweets - Tag Clouds - Harvesting Friends and Followers - Analysis of Relationships, Cliques - Geodata.

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

REFERENCE BOOKS:

1. Richard Heimann, Nathan Danneman, "Social Media Mining with R", Packt Publishing, March 2014.
2. Mining the Social Web, 2nd Edition Data Mining Face book, Twitter, LinkedIn, Google+, GitHub,and More By Matthew A. Russell Publisher: O'Reilly Media.

WEB REFERENCES:

1. Lei Tang, Huan Liu "Community Detection and Mining in Social Media", Morgan and Claypool Publishers, 1st Edition, 2010.
2. Matthew A. Russell, "21 Recipes for Mining Twitter", O'Reilly Media, January 2011.
3. Yangchang Zhao, "R and Data Mining, Examples and Case Studies", Academic Press; 1st Edition, 2012

ADVANCED OPERATING SYSTEMS
(PROFESSIONAL ELECTIVE-V)

II M.Tech I Semester **L T P C**

Course Code: B1CS314PE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. To discuss limitations of widely-used operating systems, introduce new design approaches to address challenges of security, robustness, and concurrency
2. To give an understanding of practical engineering issues in real-time and concurrent systems.
3. Be proficient in details of operating systems and be sensitive to implementation and performancetuning of operating systems in preparation to entering the industry or in pursuit of graduate studies.

COURSE OUTCOMES:

Upon successful completion of this course, students are expected to have the ability to:

1. Describe and explain the advanced components of a computer operating system
2. Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems.
3. Understand new design approaches to address challenges of security, robustness, andconcurrency.
4. Implement and performance tuning of operating systems in preparation to entering the industry or in pursuit of graduate studies.

UNIT - I

Real-time operating systems: Modeling Timing constraints, Handling Resource sharing among real-time tasks, Scheduling Real-Time Tasks in Multiprocessor and Distributed systems Real-Time Databases andcase study.

UNIT- II

Distributed operating system: Design issues, Communication in Distributed System, Distributed File Systems and case study.

UNIT-III

Network operating system: Standards & Protocols; Addressing.

UNIT- IV

Kernel development: Issues and development principles, case study.

UNIT- V

Protection, privacy, access control and security issues, solutions.

TEXT BOOKS:

1. A. Silberschatz - Applied Operating System Concepts, Wiley, 2000
2. Lubemir F Bic and Alan C. Shaw - Operating System Principles, Pearson Education, 2003
3. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008. Andrew Tanebaum,Maarten Van Steen “Distributed Systems: Principles and Paradigms

REFERENCE BOOKS:

1. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.
2. Operating Systems: Internal and Design Principles - Stallings, 6th ed., PE
3. Modern Operating Systems, Andrew S Tanenbaum 3rd ed., PE.
4. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 7th ed.,, JohnWiley
5. UNIX User Guide – Ritchie & Yates.
6. UNIX Network Programming - W.Richard Stevens, 1998, PHI. 6. The UNIX ProgrammingEnvironment – Kernighan & Pike, PE.

REINFORCEMENT LEARNING
(PROFESSIONAL ELECTIVE –V)

II M.Tech I Semester **L T P C**

Course Code: B1CS315PE **3 - - 3**

COURSE OBJECTIVESRE

The course should enable the students to learn:

1. course should enable the students to learn:
2. Learn how to define RL tasks and the core principals behind the RL, including policies, value functions, deriving Bellman equations (as assets by the assignments, an exam and quizzes)
3. Implement in code common algorithms following code standards and libraries used in RL (as assessed by the assignments and final project)
4. Understand and work with tabular methods to solve classical control problems (as assessed by the assignments, quizzes and final exam)
5. Understand and work with approximate solutions (deep Q network based algorithms) (as assessed by the assignments and final exam)
6. Learn the policy gradient methods from vanilla to more complex cases (as assessed by the assignments, quizzes and final exam)
7. Explore imitation learning tasks and solutions (as assessed by the quizzes and final exam) • Recognize current advanced techniques and applications in RL (as assessed by the final project, quizzes and final exam)

COURSE OUTCOMES:

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

1. Understand the need for machine learning for various problem solving
2. Familiarize the basics of Reinforcement Learning
3. Explain various tabular solution methods
4. Familiarize in approximate solution methods
5. Explain about classic conditioning and explore few applications

UNIT – I

Introduction to Machine Learning : Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT – II

Introduction to Reinforcement Learning and optimization: Reinforcement Learning: Introduction - Elements of Reinforcement Learning - Limitations and Scope- An Extended Example: Tic-Tac-Toe- Multi-armed Bandits: K {PAGE} armed, test beds, incremental implementation, Optimal initialization- Gradient Bandit, associative Search.

UNIT – III

Basic Tabular Solution Methods: Finite Markov Decision Processes- Goals, Rewards, Returns, Episodes- Optimal policies and optimal valued functions. Dynamic Programming: Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration- Asynchronous Dynamic Programming - Generalized Policy Iteration. Monte Carlo Methods: Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off-policy Prediction via Importance Sampling. Temporal-Difference Learning: TD Prediction - Advantages of TD - Incremental Implementation - Off-policy Monte Carlo Control.

UNIT – IV

Approximate Solution Methods : On-policy Prediction with Approximation : Value-function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods –Feature Construction for Linear Methods- Nonlinear Function Approximation: Artificial Neural Networks - Least-Squares TD - Memory-based Function Approximation - Kernel-based Function Approximation.

UNIT – V

Classical Conditioning & Case studies Classical Conditioning : Blocking and Higher-order Conditioning - The Rescorla -Wagner Model - TD Model -Simulations - Instrumental Conditioning - Delayed Reinforcement- Cognitive Maps. Case Studies: Samuel's Checkers Player, Optimizing Memory Control, Human-level Video Game Play- Autonomous UAV Navigation and path planning -Drones for Field Coverage.

TEXT BOOKS:

1. Richard S.Sutton and Andrew G. Barto, , Introduction to Reinforcement Learning‘,2nd Edition, MIT Press, 2017.
2. Tom M.Mitchell,―Machine Learning,McGraw-Hill Education (India) Private Limited, 2013

REFERENCE BOOKS:

1. Sigaud O.&Buffet O. ,Markov Decision Processes in Artificial Intelligence‘, editors, ISTE Ld., Wiley and Sons Inc, 2010.
2. Dragun Vrabie,Kyriakos G.Vamvoudakis,Frank L.Lewis.,Optimal Adaptive Control and Differential Games by Reinforcement learning principles,2012.

SOFTWARE PROJECT MANAGEMENT
(OPEN ELECTIVE)

II M.Tech I Semester **L T P C**

Course Code: B1CS301OE **3 - - 3**

COURSE OBJECTIVES:

1. To provide fundamental concepts of Service Oriented Architecture.
2. To inculcate knowledge about SOAP, UDDI and XML to create web services.
3. To teach Cloud Computing architecture and services with respect to SOA

COURSE OUTCOMES:

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

1. Apply the principles of service oriented architecture
2. Adopt the standards and technologies of modern web services implementations
3. Effectively use market-leading development tools to create and consume web services
4. Identify and select the appropriate framework components in the creation of web servicesolutions
5. Apply object-oriented programming principles to the creation of web service solutions
6. Analyze the requirements of a medium-difficulty programming task, and create software thatmeets the requirements.

UNIT - I

Conventional Software Management: The waterfall model, conventional softwareManagement performance.
Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

UNIT - II

Software Economics Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections. The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT - III

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, Transitionphases.
Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, Programmaticartifacts.
Model based software architectures: A Management perspective and technical perspective.WorkFlows of the process: Software process workflows, Iteration workflows.

UNIT - IV

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.Iterative Process Planning: work breakdown structures, planning guidelines, cost and schedule Estimating, Iteration planning process, Pragmatic planning.
Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building blocks, The Project Environment.

UNIT - V

Project Control and Process instrumentation: The seven core Metrics, Management
Indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.Tailoring the Process: Process discriminates.
Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process transitions.
Case Study: The command Center Processing and Display system- Replacement (CCPDS- R).

TEXT BOOKS:

1. Software Project Management, Walker Royce: Pearson Education, 2005.
2. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.

REFERENCE BOOKS:

1. Software Project Management, Joel Henry, Pearson Education
2. Software Project Management in practice, Pankaj Jalote, Pearson Education.2005.

INTERNET OF THINGS
(OPEN ELECTIVE)

II M.Tech I Semester	**L T P C**
Course Code: B1CS302OE	**3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

5. To understand the fundamentals of Internet of Things.
6. To learn about the basics of IOT protocols.
7. To build a small low cost embedded system using Raspberry Pi and Adriano board.
8. To apply the concept of Internet of Things in the real world scenario.

COURSE OUTCOMES:

5. Able to understand the application areas of IOT
6. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
7. Able to understand building blocks of Internet of Things and characteristics.
8. To classify Real World IoT Design Constraints, Industrial Automation in IoT.

UNIT - I

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT - II

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT - III

IOT Protocols & Building IOT with Arduino: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

Introduction to microcontroller and microprocessor, Arduino Board Layout and architecture, Programming with Arduino IDE, Reading data from analog or digital sensors, writing data to analog PWM or Digital actuators.

UNIT - IV

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python.

UNIT - V

Case Studies and Real – World Applications Functions: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖,UniversitiesPress, 2015.

REFERENCE BOOKS:

7. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖,UniversitiesPress, 2015.
8. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
9. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRCPress, 2012.
10. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
11. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.
12. B. A. Forouzan, R. F. Gillberg, “C Programming and Data Structures”, Cengage Learning, India, 3rd Edition, 2014.

WEB REFERENCES:

3. https://wso2.com/whitepapers/a-reference-architecture-for-the-internet-of-things/
4. http://www.ti.com/ww/en/internet_of_things/iot-applications.html

E-TEXT BOOKS:

3. https://cloud.oracle.com/en_US/opc/iot/ebooks
4. https://www.vitalsource.com/en-uk/products/analytics-for-the-internet-of-things-iot-andrew-minteer-v9781787127579

ADHOC AND SENSOR NETWORKS
(OPEN ELECTIVE)

II M.Tech I Semester **L T P C**

Course Code: B1CS303OE **3 - - 3**

COURSE OBJECTIVES:

The course should enable the students to:

1. Describe the concepts of adhoc wireless networks.
2. Analyze different routing protocols of mobile adhoc networks.
3. Apply the energy management policies in routing algorithms.
4. Implement protocols for location based QoS.
5. Design and simulate sensor networks and evaluate performance.

COURSE OUTCOMES:

1. Students will be able to describe an adhoc network and analyze various technologiesassociated with it.
2. Students will be able to analyze various transport layer and analyze various protocolsassociated with it.
3. Students will apply this knowledge to analyze adhoc & sensor based networks and compute various parameters associated with it.
4. Students will Discuss the challenges in designing routing and transport protocols for wireless Ad-hoc/sensor networks

UNIT - I

Ad Hoc Wireless Networks and MAC Introduction: Issues in ad Hoc wireless networks, issues in designing a MAC protocol for ad hoc wireless networks, design goals of a MAC protocols for ad hoc networks, classifications of MAC protocols.

UNIT - II

Routing Protocols in Ad Hoc Networks: Issues in designing a routing protocol for ad hoc wireless networks, classifications of routing protocols, table driven routing protocol, on-demand routing protocols, hybrid routing protocols, hierarchical routing protocols, and power aware routing protocols.

UNIT - III

Energy Management in Ad hoc Wireless Networks: Energy-Efficient Communication in Ad Hoc Wireless Networks, Ad Hoc Networks Security, Self-Organized and Cooperative Ad Hoc Networking, Simulation and Modeling of Wireless, Mobile, and Ad Hoc Networks, Modeling Cross-Layering Interaction Using Inverse Optimization, Algorithmic Challenges in Ad Hoc Networks.

Energy Management in Ad hoc Wireless Networks: Introduction, need for energy management in ad hoc networks, battery management schemes-overview of battery characteristic, device dependent schemes.

UNIT - IV

Quality of Service in Ad Hoc Wireless Networks: Introduction, issues and challenges in providing QoS in ad hoc networks, classification of QoS solutions, MAC layer solutions, QoS routing protocols, ticket based, predictive location based QoS routing protocols.

UNIT - V

Wireless Sensor Networks: Introduction, sensor network architecture, data dissemination, gathering, MAC protocols for sensor networks–self organizing, hybrid TDMA/FDMA, CSMA based MAC, location Discovery.

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks-Architectures andProtocols, New Delhi: Pearson Education, 2013.
2. "Adhoc and Sensor Networks" by Stefano Basagni, Silvia Giordano, Ivan Stojmenvic.IEEE Press, A John Wiley & Sons, Inc., Publication 2004.

REFERENCE BOOKS:

1. Feng Zhao and Leonidas Guibas, Wireless Sensor Networks. Noida: Morgan Kaufman Publishers, 2004.
2. C. K. Toh, Ad Hoc Mobile Wireless Networks. New Delhi: Pearson Education, 2002.
3. Thomas Krag and SebastinBuettrich, Wireless Mesh Networking. Mumbai: O'ReillyPublishers,2007

INFORMATION RETRIEVAL SYSTEMS
(OPEN ELECTIVE)

II M.Tech I Semester **L T P C**

Course Code: B1CS304OE **3 - - 3**

COURSE OBJECTIVES:

1. To learn the different models for information storage and retrieval
2. To learn about the various retrieval utilities
3. To understand indexing and querying in information retrieval systems
4. To expose the students to the notions of structured and semi structured data
5. To learn about web search

COURSE OUTCOMES:

On completion of this Course the student will be able to

1. Understand the information retrieval strategies.
2. Analyze and use the various retrieval utilities for improving searching concepts.
3. Apply various retrieval utilities on crossing language barrier.
4. Understand the indexing and compressing documents to improve the space and time efficiency.
5. Understand the integrated structured data and distributed information retrieval applies on web search.

UNIT - I

Introduction to Information Retrieval Strategies: Vector space model, Probabilistic retrieval strategies: Simple term weights, Nonbinary independence model, Language Models.

UNIT- II

Retrieval Utilities: Relevance feedback, Clustering, N-grams, Regression analysis, Thesauri.

UNIT- III

Retrieval Utilities: Semantic networks, parsing.
Cross-Language Information Retrieval: Introduction, Crossing the language barrier.

UNIT-IV

Efficiency: Inverted index, Query processing, Signature files, Duplicate document detection.

UNIT - V

Integrating Structured Data and Text: A Historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema.
Distributed Information Retrieval: A Theoretical model of distributed retrieval, Web search

TEXT BOOKS:

1. Information Retrieval: Algorithms and Heuristics By David A Grossman and Ophir Frieder, 2nd Edition, Springer.
2. Gerald J. Kowalski, Mark T. Maybury (2000), Information Storage and Retrieval Systems: Theory and Implementation, 2ndedition, Springer International Edition, USA.

REFERENCE BOOKS:

1. Information retrieval data structures and algorithms By William B Frakes, Ricardo Baeza-Yates, Pearson Education, 2007
2. Information storage & retrieval By Robert Korfhage-John Wiley&sons
3. Natural language processing and information retrieval By U.S. Tiwary, Oxford University.