ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

COMPUTER SCIENCE AND ENGINEERING

FOR

M.TECH TWO YEAR DEGREE COURSE

(Applicable for the batches admitted from 2022-2023)

G. Narayanamma Institute of Technology and Science

(for women)

(AUTONOMOUS)

Shaikpet, Hyderabad –500104. T.S.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT VISION

To provide engineering education in the field of Computer Science with evolving technologies and to produce self-motivated, employable individuals to society.

DEPARTMENT MISSION

- To pioneer education in Computer Science and Engineering, Mathematics and Sciences, to mould the overall personality of students.
- To nurture the students to be dynamic, industry ready and to have multidisciplinary skills and leadership qualities.
- To inculcate work ethics and commitment in students for their future endeavors to serve the society.

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (for WOMEN)
(Autonomous)
Shaikpet, Hyderabad – 500 104

ACADEMIC REGULATIONS (R22)
for CBCS Based M.Tech. Degree Programme (Regular/Full Time PG Course) in

COMPUTER SCIENCE AND ENGINEERING

(Effective for the students admitted into I year from the
Academic Year 2022-23 and onwards)

1.0 Post-Graduate Degree Programme (PGDP) in Engineering & Technology (E & T)

G. Narayanamma Institute of Technology & Science (GNITS) - for Women, Hyderabad, affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, offers 2 Year (4 Semesters) Master of Technology (M. Tech.) Degree Programmes under Choice Based Credit System (CBCS), with effect from the Academic Year 2022 - 23 onwards in the following Branches of Engineering & Technology with the Specializations as listed below:

S.No.	*Branch/ Department*	*Specialization*
I.	Computer Science & Engineering	Computer Science & Engineering
II.	Electrical & Electronics Engineering	Power Electronics & Electric Drives
III.	Electronics & Communication Engineering	Digital Electronics & Communication Engineering
IV.	Electronics & Telematics Engineering	Wireless & Mobile Communications
V.	Information Technology	Computer Networks & Information Security

2.0 Eligibility for Admission

2.1 Admission to the **PGDP** shall be made either on the basis of - the Rank/Percentile earned by the candidate in the relevant qualifying GATE Examination, OR the Merit Rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (PGECET) for M.Tech. Programmes, OR an Entrance Test conducted by the Jawaharlal Nehru Technological University Hyderabad, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

2.2 The medium of instruction for all the PG Programmes shall be ENGLISH only.

3.0 M.Tech. Degree Programme Structure

3.1 All M.Tech. Programmes at GNITS are of the Semester Pattern with 4 Semesters constituting 2 Academic Years, and each Academic Year has TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations) with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for the various terms and abbreviations used in this PGDP - Academic Regulations/Norms.

3.2.1 Semester Scheme:

Each M.Tech. Degree Programme is of 2 Academic Years (4 Semesters) with each academic year divided into two Semesters of ~ 22 weeks (≥ 90 working days) each, and each semester has - 'Continuous Internal Evaluation (CIE)' and 'End Semester Examination or Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted and suggested by UGC and AICTE are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' or 'COURSE' imply the same meaning here, and refer to 'Theory Subject', or 'Lab/Practical Course', or 'Elective (Program Specific Elective/ Open Elective)', or 'Mini-Project', or 'Seminar', or 'Project', or 'Audit Course' as the case may be.

3.2.2 Credit Courses:

All the Subjects/Courses are to be registered by a student in a semester to earn Credits. Credits shall be assigned to each Subject/ Course in a **L: T: P: C** (**L**ecture Periods: **T**utorial Periods: **P**racticalsPeriods:**C**redits) Structure, based on the following general pattern:

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses, and Tutorials (T); and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses.
- Audit Courses shall not carry any Credits.

3.2.3 Subject/ Course Classification:

All Subjects/ Courses offered for the PGDP are broadly classified as:

(a) Core Courses (CoC), and

(b) Elective Courses (E*l*C)

Core Courses (CoC) and Elective Courses (E*l*C) are categorized as PS (Professional Subjects), which are further subdivided as –

(i) PC (Professional/ Departmental Core) Courses

(ii) PSE (Program Specific Elective) Courses

(iii) OE (Open Elective) Courses; and

(iv) Project Works (PW);

Specific prescribed Course by AICTE Model Curriculum (on "Research Methodology & IPR").

Audit Courses (AC - as listed by AITCTE Model Curriculum).

3.2.4 Course Nomenclature:

The Curriculum Nomenclature and Course Structure grouping for GNITS M.Tech. Degree Programmes are as listed below:

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Courses Description*	*Credits*
1)	**Core Courses(CoC)**	**PC - Professional Core**	Includes Core subjects related to the Parent Department/ Branch of Engg.	**18**
2)	**Elective Courses (E*l*C)**	**PSE – Program Specific Elective**	Includes Elective subjects related to the Parent Department/ Branch of Engg.	**15**
		OE - Open Elective	Elective Courses which include subjects from other technical and/or Emerging Areas	**3**
3)	**Project Related Courses**	**PW - Project Work**	M.Tech. Project or PG Project or PG Major Project (Phase-I and Phase-II)	**26**
		Mini-Project (MP)	Mini-Project over 1 semester duration	**2**
		Seminar	Seminar based on core contents related to the Parent Department/ Branch of Engg. in identified specialization	**2**
4)	Prescribed Course	**AICTE Model Curriculum 2018**	Research Methodology & IPR	**2**
5)	Audit Courses	**AC – as per AICTE Model Curriculum 2018**	Inclusive of AICTE Suggested List	**No Credits**
Total Credits for PGDP (For the Specializations Listed)				**68**

4.0 Course Work

4.1 A student, after securing admission, shall pursue and complete the M.Tech. Degree Programme in a minimum period of 2 Academic Years (4 Semesters), and/or within a maximum period of 4 Academic Years (starting from the Date of Commencement of I Year).

4.2 Each student shall register for and secure the specified number of Credits required for the completion of the PG Degree Programme and Award of the M.Tech. Degree in the respective Branch of Engineering with the chosen Specialization.

4.3 The I Year is structured to provide typically 18 Credits in each of the I and II Semesters, and II Year comprises of 16 Credits in each of the I and II semesters,totalling to 68 Credits for the entire M.Tech. Programme.

5.0 Course Registration

5.1 A 'Faculty Advisor' shall be assigned to each M.Tech. Degree Programme student with respective Specialization, and the Faculty Advisor assigned shall advise/counsel the student about the M.Tech. Programme Specialization, its Course Structure and Curriculum, Choice/ Option for Subjects/ Courses, based on the competence, progress, pre-requisites and interest of the student.

5.2 The Academic/Examination Section of the College invites 'Registration Forms' from the students apriori (before the beginning of the Semester) through 'ONLINE SUBMISSIONS' ensuring 'DATE and TIME Stamping'. The ONLINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 A student can apply for ONLINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from her assigned Faculty Advisor, which should be submitted to the College Academic/Examination Section through the Head of the Department (a copy of the same being retained with the Head, Faculty Advisor and the Student).

5.4 A student shall Register for Subjects/Courses of 'her CHOICE' with a total of 18 Credits per semester in the I Year as structured in the Programme Curriculum, which will be treated as the Minimum Work Load; she may also seek registration for a maximum of 3 additional/extra credits from those specified for the II Year I Semester (Maximum Work Load thus limited to 21 C) based on her interest, competence, progress, and 'pre-requisites' as indicated for various Subjects/ Courses in the Department Course Structure (for the relevant Specialization) and the Syllabus contents for various Subjects/ Courses, as applicable. All the remaining Credits shall be registered in the II Year-I and II Semesters.

5.5 Thechoice for the 'Additional Subjects/ Courses' in the I Year (in any semester, above the typical 18 Credit norm, and within the Maximum Permissible Limit of 21 Credits, as applicable) must be indicated clearly in the ONLINE Registration, which needs the specific approval and the signature of the Faculty Advisor/Counsellor assigned and the Head of the Department on the hard-copy.

5.6 If the student submits ambiguous choices or multiple options or erroneous entries during ONLINE Registration for the Subject(s)/Course(s) under a given/specified Course Group/Category as listed in the Course Structure for that particular PGDP Specialization, ONLY the first mentioned Subject/ Course in that Category will be taken into consideration, as applicable.

5.7 The Subject/Course Options exercised through ONLINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices shall also not be considered. However, if the Subject/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 may be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements shall be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that semester.

5.8 The Dropping of Subjects/ Courses in any semester of the I Year may be permitted, ONLY AFTER obtaining prior approval and signature from the Faculty Advisor (subject to retaining the minimum of specified 18 Credits) 'within 15 Days of Time' from the beginning of the current semester.

6.0 Class Strength

6.1 The typical student strength for each semester shall be 12 (or as per JNTUH / AICTE Approved Intake).

6.2 A Subject/Course may be offered to the students, ONLY IF a minimum of 50% of the students of a PG Specialization opt for the same.

6.3 In case of the options for Subjects/Courses coming from students of other Departments /Branches/ Disciplines also, PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the Semester End Examination (SEE) of any Subject, if she acquires a minimum of 75% of attendance in that Subject for that semester.

7.2 The condoning of shortage of attendance up to 10% in each Subject (for 65% and above, and below 75% attendance cases) of a semester may be granted by the College Academic Committee (CAC) on genuine and valid grounds based on the student's representation with supporting evidence.

7.3 A stipulated fee per Subject/Course shall be payable towards condoning of shortage of attendance.

7.4 The Shortage of Attendance below 65% in any Subject shall in NO case be condoned.

7.5 A student, whose shortage of attendance is not condoned in any Subject(s) in any semester, is considered as 'Detained Student in that Subject(s)', and is not eligible to take End Examination(s) in the Subject(s) detained in that semester; and she has to seek Re-registration for those Subject(s) in subsequent semesters, and attend the same as and when offered.

7.6 Every studentshall put in the minimum required attendance (as specified in Clauses 7.1-7.3) in at least 3 theory subjects and 2 lab courses – (i) in I Year I Semester, for promotion to I Year II Semester, and similarly - (ii) in I Year II Semester along with the Mini-Project, for promotion to II Year I Semester.

7.7 A student shall not be promoted to the next semester unless she satisfies the attendance requirements of the present semester, as applicable. In such cases, she may seek readmission into that semester (and register for all semester subjects), as and when offered. When she fulfils the attendance requirements in the present semester, she shall not be eligible for readmission (or re-register) into the same class/semester again.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Clause 7.0 …

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if she secures not less than

- 40% marks (24 out of 60 marks)in the Semester End Examination (SEE),
- 40% marks in the Internal Examinations (16 out of 40 marks allotted foe CIE) and
- A minimum of 50% of marks (50 out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing C Grade or above in that Subject.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Mini-Project/ Seminars, if she secures not less than 50% of the total marks allocated. The student would be treated as failed, if she - (i) does not execute the Mini-Project (and submit the report) as specified by the Supervisor, or (ii) does not present the Seminars as required, or (ii)

secures less than 50% of Marks (< 50 marks) in evaluations. She may reappear once for each of the 'Mini-Project/ Seminars' evaluations, as and when they are scheduled again; if she fails in such 'one reappearance' evaluation also, she has to reappear for the same in the next subsequent semester(s), as and when they are scheduled.

8.3 A student shall register for all Subjects covering 68 Credits as specified and listed in the Course Structure for the chosen M.Tech. Degree Specialization, put up all the Attendance and Academic requirements for securing 68 Credits obtaining a minimum of C Grade or above in each Subject, and 'earn all 68 Credits securing SGPA ≥5.0 (in each semester) and final CGPA (i.e., CGPA at the end of PGDP is to be ≥5.0), to successfully complete the PGDP. **THERE IS NO EXEMPTION OF CREDITS IN ANY CASE**

8.4 The Marks and the Letter Grades obtained in all those Subjects covering the specified 68 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card of the II Year II Semester.

8.5 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/ Branches of Engg.) other than those listed Subjects totalling to 68 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 68 Credits) shall not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, the Letter Grade alone shall be indicated in the Grade Card as a performance measure, subject to the completion of the Attendance and Academic Requirements as stated in Clauses 7.0 and 8.1 – 8.4 above.

8.6 The students who fail to earn 68 Credits as per the specified Course Structure, and as indicated in Clauses 8.1- 8.5, within 4 Academic Years from the Date of Commencement of their I Year, shall forfeit their seats in M.Tech. Programme, and their admissions shall stand cancelled.

8.7 When a student is detained due to the shortage of attendance in any Subject(s) in any semester, no Grade Allotment shall be done for such Subject(s), and SGPA/ CGPA calculations of that semester shall not include the performance evaluations of such Subject(s) in which she gets detained. However, she becomes eligible for re-registration of such Subject(s) (in which she gets detained) in the subsequent semester(s), as and when offered next, with the Academic Regulations of the Batch into which she gets readmitted, by paying the stipulated fees per Subject to the College. In all these re-registration cases, the student shall have to secure a fresh set of Internal Marks (CIE) and Semester End Examination Marks (SEE) for performance evaluation in such Subject(s), and subsequent SGPA/ CGPA calculations.

8.8 A student, eligible to appear for the End Semester Examination (ESE) in any Subject, but is absent at it or failed (failing to secure C Grade or above), may reappear for that Subject at the supplementary examination (Supplementary SEE) as and when conducted. In such cases, her Internal Marks (CIE) assessed earlier for that Subject/ Course will be retained, and added to the marks to be obtained in the supplementary examination (Supplementary SEE) for the evaluation of her performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of the Credits assigned) with a maximum of 100 marks for the Theory or Practicals or Mini-Project, or Seminar etc; further, Phase-I and Phase-II of the M.Tech. Project Work (in II Year I and II semesters) shall also be evaluated for 100 marks each. These evaluations shall be based on 40% CIE and 60% SEE, and a Letter Grade corresponding to the % of marks obtained shall be given.

9.2 For all the Subjects/ Courses as mentioned in 9.1**,** the distribution shall be: 40 marks for CIE (Continuous Internal Evaluation), and 60 marks for the SEE (Semester End Examination).

9.3 **a)** In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid-Term Examination for 30 marks:
   a. Part - A: Objective/quiz paper for 10 marks.
   b. Part – B: Descriptive paper for 20 marks.

   The objective/quiz paper is set with 10 questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks). The remaining 10 marks of Continuous Internal Assessment (out of 40) are distributed as:
2. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.

   While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

   Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

   Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.
- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 40% (16 marks) of 40 Continuous Internal Examination (CIE) marks.*
- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 40% of CIE marks (16 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.*

b) 60 marks are allocated for Semester End Examination (SEE), which is of 3 hours duration. The SEE Question Paper will have two parts: Part-A is for 10 marks and is compulsory - it consists of 10 questions of 1 mark each (2 questions from each unit) and Part-B is for 50 marks – it consists of 5 questions of 10 marks each, for each question there will be 'either/ or' choice, which means that there will be two questions from each unit and the student should answer one of these two.

9.4 For the Lab./Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks, and Semester End Examination (SEE) at the end of the semester for 60

marks. Out of the 40 marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 marks; the performance in an Internal Lab./Practical Test (10 marks) and viva-voce (10 marks) shall be evaluated for a total of 20 marks. The Semester End Examination (SEE) for Lab./ Practicals shall be conducted at the end of the semester by the Lab. Teacher concerned and another faculty member of the same Department as assigned by the Head of the Department.

The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥40% (16 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 40% of CIE marks (16 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE

9.5 **a)** There shall be a Mini-Project, preferably in collaboration with an Industry with the relevant specialization to be registered and executed during the I Year II Semester, for about sixteen weeks duration. It shall also carry 100 marks, out of which CIE shall be for 40 marks, and SEE shall be for 60 marks. Marks earned under CIE for the 'Mini-Project' shall be awarded by the Mini-Project Guide/Supervisor (based on the continuous evaluation of student's performance during the Mini-Project execution period).

b) The Mini-Project work shall be submitted in a Technical Report form, and a presentation of the same shall be made before a Committee, and the 'Mini-Project' shall be evaluated by the Committee for 60 Marks (SEE).The Committee shall consist of the Head of the Department, the Supervisor of Mini-Project, and a Senior Faculty Member of the Department. Performance evaluation of the 'Mini-Project' shall be included in the I Year II Semester Grade Card.

9.6 **Electives:** 5 Program Specific Elective (PSE) Courses and 1 Open Elective (OE) Course are offered in the 4 Semester PG Degree Programme at GNITS, as per AICTE Model Curriculum. Students are to choose each Elective Course from the corresponding Set of Electives given, and the evaluation of the Elective Course shall be the same as that for the Theory Course/Subject.

9.7 There shall be Seminar Presentations in the I Year, I and II Semesters. For the Seminar, the student shall collect the information on a technical topic, prepare a Technical Report and submit the Technical Report to the Department at the time of Seminar Presentation. Each Seminar Presentation (along with the Technical Report submitted) shall be evaluated for 100 marks by Two Faculty Members assigned by the Head of the Department. There shall be no SEE or external examination for the Seminar.

9.8 Every student shall be required to execute her M.Tech. Project under the guidance of the Supervisor assigned to her by the Head of the Department, and shall submit her dissertation on a topic relevant to her PG specialization.

a) The M.Tech. Project shall start immediately after the completion of the I Year II Semester, and shall be divided and carried out in 2 phases: Phase–I during II Year I Semester, and Phase–II during II Year II Semester. The student shall prepare and submit two independent Project Work Reports - Project Work Report-I shall include the Project Work carried out under Phase–I, and the Project Work Report-II (Final Report) shall include the Project Work carried out under Phase–I and Phase–II put together.

b) In Phase-I of the Project Work,the student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after her I Year II Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department, Project Supervisor, and a Senior Faculty Member of the Department. The student shall present her Project Work Proposal to the PRC (PRC-I Presentation), on whose approval she can 'REGISTER for the M.Tech Project'. Every student shall compulsorily register for her M.Tech. Project Work, preferably within the 6 weeks of time frame as specified.

c) After the Registration, the student shall carry out the work, and periodically submit 'a periodic progress report' to her Supervisor throughout the Project period. The PRC shall monitor the progress of the Project Work and review, based on the PRC-II and PRC-III presentations and performance evaluations – the first one at the middle of the II Year I Semester, and the second one at the end of the II Year I Semester (before the I Semester End Examinations). The student shall also submit the Project Work Report-I to the PRC at PRC-III, for the PRC considerations and evaluations.

d) 100 marks are allocated for each Phase (Phase-I and Phase-II) of the Project Work, out of which 40 marks shall be for CIE (Continuous Internal Evaluation/CIE), and 60 Marks will be for SEE (Semester End viva-voce Examination).

e) The marks earned under CIE for the Phase-I of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance, all her PRC presentations during the Project Work Phase-I period and Project Work Report-I). For SEE marks of Project Phase-I, the Project Work Report-I shall be examined, and viva-voce shall be conducted at the end of the II Year I Semester (along with PRC-III) by the PRC, and the corresponding SEE marks shall be awarded.

f) The Phase-II of the Project shall be carried out in the II Year II Semester, and the student's progress and performance evaluation shall be carried out through PRC-IV (at the middle of the semester), and PRC-V (at the end of the II semester) presentations. The student shall submit the Project Work Report-II (Final Project Report or Dissertation Draft Copy) to the PRC at PRC-V, for the PRC-V considerations and evaluations. Marks earned under CIE for Phase-II of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance, all her PRC presentations during the Project Work Phase-II period and Project Work Report-II). Marks earned under SEE for Phase-II Work shall be awarded by the External Examiner, after the evaluation of the M.Tech. dissertation and the final viva-voce examination of the M.Tech. Project Work.

g) After the PRC-V presentation, the PRC shall evaluate the entire performance of the student and declare the Project Work as 'Satisfactory' or 'Unsatisfactory'. Every Final Project Work Report (that has been declared 'satisfactory') shall undergo 'Plagiarism Check' as per the University/ College norms to ensure the plagiarism content to be below the specified level of 30%, to be acceptable for submission. In case of the unacceptable plagiarism levels, the student shall resubmit the Modified Project Work Report/Dissertation, after carrying out the necessary modifications/ additions to her Project Work/Report as suggested by the PRC, within the specified time.

h) If any student could not be present for any PRC at the scheduled time (after approval and registration of her Project Work at the PRC-I), or her progress is considered as 'not satisfactory' at any scheduled PRC, she will have to reappear (within one month period) for the same PRC presentation and evaluation at a later date/time as suggested by the PRC.

i) A student is allowed to submit her M.Tech. Project Dissertation 'only after the completion of 40 weeks from the date of approval/registration' of her Project, and after obtaining all the approvals from the PRC. The extension of time, within the total permissible limits of completion of the PGDC may be considered by the PRC on sufficient valid, genuine grounds.

j) The student shall be allowed to submit her M.Tech. Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Labs.), Mini-Project, Seminars etc. (securing C Grade or above), and after obtaining all approvals from PRC. In such cases, the M.Tech. Dissertation will be sent to an External Examiner nominated by the Principal of the College, from the panel of 3 names of external faculty members (Professors or Associate Professors, outside the college) suggested by the Head of Department, on whose approval, the student can appear for the M.Tech. Project viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicated the M.Tech. Project Work and Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 60 Marks (SEE).

k) If the adjudication report of the External Examiner is 'not favourable', then the student shall revise and resubmit her M.Tech Dissertation after one semester, or as per the time specified by the External Examiner and/ or the PRC. If the resubmitted report is again evaluated by the External Examiner as 'not favourable', then that Dissertation will be summarily rejected. Subsequent actions for such rejected dissertations may be considered, only on the specific recommendations of the External Examiner and/ or PRC.

l) In cases, where the Board declared the Project Work Performance as 'unsatisfactory', the student is deemed to have failed in the Project viva-voce Examination, and she may reappear for the viva-voce Examination as per the Board's recommendations. If she fails in the second viva-voce Examination also, she shall not be considered eligible for the Award of the Degree, unless she is asked to revise and resubmit her Project Work by the Board within a specified time period (with in 4 years from the date of commencement of her I Year I Semester).

10.0 Re-Admission / Re-Registration

10.1 Re-Admission for Discontinued Students:

The student who has discontinued the M.Tech. Degree Programme on account of any reasons whatsoever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which she get readmitted, with prior permission from the authorities concerned, subject to Clause 4.1.

10.2 Re-Registration for Detained Students:

When any student is detained in a Subject(s) on account of the shortage of attendance in any semester, she may be permitted to re-register for the same Subject(s) in the 'same category' (Core or Elective Group) or equivalent Subject(s) if the same Subject is not available, as suggested by the BoS Chair of that Department, as and when offered in the sub-sequent semester(s), with the Academic Regulations of the Batch into which she seeks re-registration, with prior permission from the authorities concerned, subject to Clause 4.1.

11.0 Grading Procedure

11.1 The marks shall be awarded to indicate the performance of each student in each Theory Subject, or

Lab/Practicals, or Mini-Project, or Seminar, or Project etc., and based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Clause 9.0, a corresponding Letter Grade shall be given.

11.2 A Letter Grade does not imply any specific % of marks.

11.3 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 (GP)*
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 55% (≥ 55%, < 60%)	B(above Average)	6
Below 55% but not less than 50% (≥ 50%, < 55%)	C(Average)	5
Below 50% (< 50%)	F(FAIL)	0

11.4 A student obtaining F Grade in any Subject shall be considered 'failed'. If a student fails to appear for SEE of any Subject (s) for any reason whatsoever, she is deemed to have 'failed', and she will get F Grade in all such failed Subject (s). She will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), in the subsequent semesters, as and when offered. In such cases, her Internal marks (CIE marks) in those Subject(s) will remain same as those she obtained earlier.

11.5 In general, a student shall not be permitted to repeat any Subject(s) with the sole intention of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, she has to repeat all those Subject(s), in which she got 'detained due to lack of required attendance' (as listed in Clauses 8.7 and 10.2), through Re-Registration at a later date.

11.6 A student earns Grade Points (GP) in each Subject on the basis of the Letter Grade obtained by her in that Subject. Then, the corresponding 'Credit Points' (CP) are computed by multiplying theGrade Points with Credits for that particular Subject/Seminar/Comprehensive Viva-voce/Project.

Credit Points (CP) = Grade Points (GP) x Credits

11.7 The student passes the Subject/ Seminar/ Comprehensive Viva-voce/Project only when she gets GP ≥ 5 (C Grade or above).

11.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (SCP) secured from ALL the Subjects/ Seminar/ Comprehensive Viva-voce/Project 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

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \quad \textbf{.... For each semester},$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester, C_i is the no. of Credits allotted to the i^{th} Subject,

and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i^{th} Subject.

11.9 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 Second Semester onwards, at the end of each Semester, as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \quad \textbf{.... For all S Semesters registered}$$

(ie., upto and inclusive of S semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of that PGDC Specialization) the student has 'REGISTERED' from the 1st Semester onwards up to and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_i is the no. of Credits allotted to the j^{th} Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th} Subject. After Registration and completion of the I Year I Semester however, the SGPA of that Semester itself may be taken as CGPA, as there are no cumulative effects.

11.10 For the Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs shall be used.

11.11 For the calculations listed in Clauses 11.6 – 11.10, performance in the failed Subjects/ Courses (securing F Grade) shall also be taken into account, and the Credits of such Subjects/Courses shall also be included in the multiplications and summations.

11.12 Passing Standards:

a) A Student shall be declared successful or 'passed' in a semester, only when she gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire PGDP, only when she gets a CGPA ≥ 5.00; subject to the condition that she secures a GP ≥ 5 (C Grade or above) in every registered Subject/ Course in each semester (during the entire PGDP), for the Award of the Degree, as required.

b) After the completion of each semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the registered students of that semester, indicating the Letter Grades and the Credits earned. The Grade Card/Grade Sheet shall show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned), Credits earned, SGPA, and CGPA etc.

12.0 Declaration of Results

12.1 The Computation of SGPA and CGPA are done using the procedure listed in Clauses 11.6 – 11.11.

12.2 For the Final % of Marks equivalent to the computed CGPA, the following formula may be used

% of Marks = (final CGPA - 0.5) x 10

13.0 Award of Degree

13.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire M.Tech. Programme (PGDP), and secures the required number of 68 Credits (with CGPA ≥ 5.0), within the 4 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the M.Tech. Degree in the chosen Branch of Engineering, with the Specialization considered at the time of Admission.

13.2 A student who qualifies for the Award of the M.Tech. Degree (in her chosen Branch/ Specialization) as listed in Clause 13.1, shall be placed in the following Class Divisions:

AWARD OF CLASS BASED ON FINAL CGPA (at the end of the PG Programme)

First Class with Distinction	Final CGPA 8.00 or more*
First Class	Final CGPA below 8.00 but not less than 7.00
Second Class	Final CGPA below 7.00 but not less than 6.00
Pass Class	Final CGPA below 6.00 but not less than 5.00

*** Note :**

a) A student with Final CGPA (at the end of the PG Degree Programme) ≥ 8.00, and fulfilling the following conditions -

(i) should have passed all the Subjects/ Courses within the first 2 Academic Years (or 4 Sequential Semesters) from the Date of Commencement of her First Academic Year,

(ii) should not have been detained or prevented from writing the End Semester Examinations in any semester due to shortage of attendance or any other reason, shall be placed in 'FIRST CLASS with DISTINCTION'.

A student fulfilling the conditions listed under (a) above, alone will be the eligible candidate for the 'University/College Rank' and/or 'Gold Medal' considerations.

b) A student with Final CGPA (at the end of PG Degree Programme) ≥ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

13.3 A student with Final CGPA (at the end of the PG Degree Programme) < 5.00 will not be eligible for the Award of the Degree.

14.0 Withholding of Results

14.1 If a student has not paid fees to the University/College at any stage, or has pending dues against her name on account of any reason whatsoever, or if any case of indiscipline is pending against her, the result of such student may be withheld, and she shall not be allowed to into the next higher semester. The Award or issue of the Degree may also be withheld in such cases.

15.0 Transitory Regulations

15.1 A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed in her M.Tech. Degree Programme after the PGDP period of 2 years, may be considered eligible for readmission - to the same PGDP with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and/or to the same Program Specific Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the time-frame of 4 years from the Date of Commencement of her I Year I Semester), along with the Academic Regulations of the Batch into which she gets readmitted.

16.0 Student Transfers

16.1 There shall be no Branch/ Specialization transfers after the completion of the Admission Process.

17.0 Scope

i) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

ii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

iv) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College Authorities.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices / Improper conduct	Punishment
	If the student:	
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 subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student 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 subject only of all the students 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 subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3.	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject 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 , 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 subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject 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 subject.
6.	Refuses to obey the orders of the chiefsuperintendent/assistant –superintendent / any officer on duty or misbehaves or creates disturbance of anykind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge 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, eitherspoken or written or by signs or by visible representation, assaults the officer-in-charge, 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 tendencyto 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 subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students 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 subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for

		two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject 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 subject and all other subjects the student has alreadyappeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student 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 subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/ year. The student 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 andcancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations andproject work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the student 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 university for further action to award suitable punishment.	

M.Tech. 2 Year (4 semesters) Regular Programme in Department of Computer Science & Engineering (CSE)

COURSE STRUCTURE

(Applicable for the Batches admitted from the Academic Year 2022-23)

I Year I Semester

S.No	Group	Subject Code	Subject	L	T	P	Credits
1.	PC	521CA	Advanced Data Structures	3	0	0	3
2.	PC	521CB	Mathematical Foundations of Computer Science	3	0	0	3
3.	PSE1	**Program Specific Elective - 1**		3	0	0	3
		521CC	Deep Learning				
		521CD	Computer Vision				
		521CE	Introduction to Intelligent Systems				
4.	PSE2	**Program Specific Elective - 2**		3	0	0	3
		521CF	Agile Software Development				
		521CG	Distributed Systems				
		521CH	Advanced Wireless and Mobile Networks				
5.	PC	52130	Advanced Data Structures Lab	0	0	3	1.5
6.	PC	**Lab linked to Program Specific Elective – 1**		0	0	3	1.5
		52131	Deep Learning Lab				
		52132	Computer Vision Lab				
		52133	Introduction to Intelligent Systems Lab				
7.	PW	521CJ	Research Methodology and IPR	2	0	0	2
8.	PW	52134	Seminar – 1	0	0	2	1
9.	AC1	Audit Course – 1		2	0	0	-
TOTAL				**16**	**0**	**8**	**18**

I Year II Semester

S.No	Group	Subject Code	Subject	L	T	P	Credits
1.	PC	522CK	Advanced Algorithms	3	0	0	3
2.	PC	522CL	Soft Computing	3	0	0	3
3.	PSE3	**Program Specific Elective - 3**		3	0	0	3
		522CM	Data Science				
		522CN	Network Security				
		522CP	Big Data Analytics				
4.	PSE4	**Program Specific Elective - 4**		3	0	0	3
		522CQ	Distributed Databases				
		522CR	Compiler for HPC				
		522CS	Recommender Systems				
5.	PC	52236	Advanced Algorithms Lab	0	0	3	1.5
6.	PC	**Lab linked to Program Specific Elective - 3**		0	0	3	1.5
		52237	Data Science Lab				
		52238	Network Security Lab				
		52239	Big Data Analytics Lab				
7.	PW	52240	Mini Project	0	0	4	2
8.	PW	52241	Seminar - 2	0	0	2	1
9.	AC2	Audit Course - 2		2	0	0	-
TOTAL				**14**	**0**	**12**	**18**

M.Tech. 2 Year (4 semesters) Regular Programme in Department of Computer Science & Engineering (CSE)

COURSE STRUCTURE

(Applicable for the Batches admitted from the Academic Year 2022-23)

II Year **I Semester**

S.No	Group	Subject Code	Subject	L	T	P	Credits
1.	PSE5	**Program Specific Elective - 5**		3	0	0	3
		523CT	Digital Forensics				
		523CU	Human Computer Interaction				
		523CV	Cluster and Grid Computing				
2.	OE	Open Elective		3	0	0	3
3.	PW	52343	Project/ Dissertation (Phase – I)	0	0	20	10
TOTAL				**6**	**0**	**20**	**16**

II Year **II Semester**

S.No	Group	Subject Code	Subject	L	T	P	Credits
1.	PW	52444	Project/ Dissertation (Phase –II)	0	0	32	16
TOTAL				**0**	**0**	**32**	**16**

AUDIT COURSES

1) English for Research Paper Writing-521HA/522HA
2) Disaster Management-521HB/522HB
3) SANSKRIT for Technical Knowledge-521HC/522HC
4) Value Education-521HD/522HD
5) Constitution of India-521HE/522HE
6) Pedagogy Studies-521HF/522HF
7) Stress Management by YOGA-521HG/522HG
8) Personality Development through Life Enlightenment Skills-521HH/522HH

OPEN ELECTIVES :

1. Business Analytics—523GA
2. Industrial Safety—523GB
3. Operations Research—523GC
4. Cost Management of Engineering Projects—523GD
5. Composite Materials—523GE
6. Energy from Waste—523GF
7. Power from Renewable Energy Sources. —523GG

I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CA **3 0 0 3**

ADVANCED DATA STRUCTURES

Prerequisites: Data Structures

Course Objectives:

1. Able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Able to understand the necessary mathematical abstraction to solve problems.
3. Familiarize with advanced paradigms and data structure used to solve algorithmic problems.

UNIT 1: (~ 8 Lecture Hours)

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. Recent trends in hashing.

UNIT 2: (~ 8 Lecture Hours)

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 3: (~ 12 Lecture Hours)

Trees: Binary Search Trees: Definition, Properties & Operations, AVL Trees: Definition & Operations, Red Black Trees: Properties & Operations, B-Trees: Definition & Operations, 2-3 Trees: Definition & Operations, Splay Trees: Definition & Operations.

UNIT 4: (~ 9 Lecture Hours)

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

UNIT 5: (~ 8 Lecture Hours)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in JAVA, 3rd Edition, Pearson, 2012.
2. M T Goodrich and Roberto Tamassia, Algorithm Design, John Wiley, 2006.

Reference Books:

1. A.Drozdek, Data Structures and Algorithms in java, 3rd Edition, Cengage Learning, 2008.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2006.
3. SartajSahni, Data structures, Algorithms and Applications in Java, 2nd Edition, Universities Press, 2005.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm
2. https://www.cdn.geeksforgeeks.org/advanced-data-structures/
3. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
4. https://www.coursera.org/

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate various hashing techniques.
2. Analyze and construct Skip Lists.
3. Construct and analyze operations of red-black trees, B-trees and Splay trees.
4. Develop algorithms for text processing applications.
5. Predict Suitable data structures and implement algorithms for computational geometry problems.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CB **3 0 0 3**

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Prerequisites: Discrete Mathematics

Course Objectives:

1. Enhance the students' ability to think logically and mathematically.
2. Gain knowledge in discrete and continuous probability.
3. Use Graph theory for solving real world problems.
4. Solve problems using counting techniques and combinatorics.

UNIT 1: (~ 10 Lecture Hours)

Fundamentals: Random Variables, Discrete Probability Distributions, Continuous Probability Distributions, expected value, Variance, Conditional Expectation, Probability Distributions- Binomial, Poisson and Normal Distribution, Central Limit Theorem for independent and Identically distributed Random Variables, Markov Chains.

UNIT 2: (~ 10 Lecture Hours)

Statistical Inference: Introduction, Estimation of Parameters – Point Estimation, Interval Estimation, Confidence Interval for Mean, Estimating Parameters of a Markov Chain, Estimation with Dependent Samples, Test of Hypothesis – for Large samples and Small samples, Goodness-of-Fit Tests.

UNIT 3: (~ 8 Lecture Hours)

Graphs: Graphs and Graph Models, Special Types of Graphs, Applications of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring, Applications of Graph Colorings, Spanning Trees.

UNIT 4: (~ 10 Lecture Hours)

Counting: Basics of Counting, The Pigeon Hole Principle, Permutations and Combinations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients.

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms, Generating functions, Inclusion-Exclusion, Applications of Inclusion - Exclusion.

UNIT 5: (~ 7 Lecture Hours)

Computer Science and Engineering Applications: Applications related to: Data Mining- Apriori Algorithm, Distributed Systems- Election Algorithms, Computer Networks – Routing algorithms, Machine Learning - HMM Model.

Text Books:

1. Kishor S. Trivedi, Probability & Statistics with Reliability. Queuing, and Computer Science Applications, 2nd Edition, John Wiley and Sons Ltd.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
3. Joe L. Mott, Abraham Kandel, Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.

Reference Books:

1. D.S. Malik and M. K. Sen, Discrete Mathematics, Theory and Applications, Revised Edition, Cengage Learning.
2. Thomas Koshy, Discrete Mathematics with Applications, Elsevier Academic Press, 2012.
3. Douglas B. West, Introduction to Graph Theory, 2nd Edition, PHI.

Online Resources:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basic notions of discrete and continuous probability.
2. Apply selected probability distributions to solve problems.
3. Understand the methods of statistical inference, and the role that sampling distributions play in those methods.
4. Understand how graphs are used as models in variety of areas.
5. Apply various counting techniques in solving combinatorial problems.
6. Gain knowledge in various applications related to computer science.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CC **3 0 0 3**

DEEP LEARNING

(Program Specific Elective - 1)

Prerequisites: Machine Learning

Course Objectives:

1. To understand the basics of deep learning and regularization for deep learning
2. Explore the methods to develop optimized deep learning networks considering hyper parameters
3. To acquire the knowledge of recurrent and recursive nets
4. Model solutions for real life problems using Convolution neural networks and recuagilersive Neural Networks.

UNIT 1: (~ 10 Lecture Hours)

Introduction to Deep Learning: Historical Trends in Deep Learning

Deep Feed forward Networks: Example: XOR, Gradient-based learning, Hidden units, Architecture design, Back-Propagation and other differentiation algorithms.

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization under constrained problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Sharing, Sparse Representations, Bagging and Ensemble Methods, Dropout.

UNIT 2: (~ 8 Lecture Hours)

Optimization for Training Deep Models: How learning differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate second order methods, Optimization strategies and Meta-algorithms.

UNIT 3: (~ 9 Lecture Hours)

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolution Networks, Convolution neural networks and History of Deep learning.

UNIT 4: (~9 Lecture Hours)

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks-Teacher forcing and networks with output recurrence, Computing the gradient in a recurrent neural network, recurrent networks as directed graphical models, modeling sequences conditioned on context with RNNs, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks

UNIT 5: (~ 10 Lecture Hours)

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Text Book:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning -MIT Press book, 2016.

Reference Books:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations and Trends® in Signal Processing, Volume 7, Issues 3-4, ISSN: 1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science, Create Space Independent Publishing Platform (January 10, 2016).
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learning with R Version 1, Copyright 2017 Manning Publications

Online Resources:

1. https://www.coursera.org/learn/neural-networks-deep-learning
2. https://www.deeplearning.ai/program/deep-learning-specialization/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental principles of Deep Learning.
2. Understand and apply regularization for deep learning neural networks.
3. Use optimization techniques for training deep models.
4. Gain knowledge on the basics and architecture of Convolution neural networks.
5. Explore different recurrent neural networks with architecture.
6. Implement deep learning algorithms and solve real-world problems.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code:521CD **3 0 0 3**

COMPUTER VISION

(Program Specific Elective - 1)

Prerequisites:-Nil-

Course Objectives:

1. Familiarize the students with the theoretical aspects of computing with images.
2. Understand the foundation of image formation and analysis.
3. Feature extraction using Histogram Processing, Color, Edges, Texture and shape.
4. Applying basic mathematical morphology concepts and segmentation.
5. Identifying different patterns using various pattern analysis techniques.

UNIT 1: (~ 9 Lecture Hours)

IMAGE PROCESSING: Fundamental steps in Digital image processing, Components of an Image Processing System, Image sensing and acquisition, Image sampling and quantization, Basic Relationships between pixels.

LINEAR FILTERS: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, A Continuous Model of a Sampled Signal, Aliasing, Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT 2: (~ 8 Lecture Hours)

Edge Detection: Noise-Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT 3: (~ 10 Lecture Hours)

Feature Extraction: Histogram Processing, Color: Color Fundamentals, Color Models.

Texture: Representing Texture-Extracting Image Structure with Filter Banks, Representing Texture Using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes, Shape from Texture for Curved Surfaces.

UNIT 4: (~ 9 Lecture Hours)

Mathematical Morphology: Erosion and Dilation, Opening and Closing.

Segmentation by Clustering: Introduction to Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves.

UNIT 5: (~ 9 Lecture Hours)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Supervised, Unsupervised, Semi supervised, Classifiers: Bayesian Statistics, KNN, Dimensionality Reduction: PCA, ICA.

Text Books:

1. R C Gonzalez and R E woods, Addison, Digital Image Processing, 3rd Edition, Pearson, 2008.
2. David A.Forsyth and Jean Ponce, Computer Vision-A Modern Approach, 1st Edition, PHI, 2003.
3. Goodfellow, Bengio, and Courville, Deep Learning, 1st Edition, MIT Press, 2016.

Reference Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 1st Edition, Springer, 2010.
2. Robert B.Fisher, TobyP. Breckon, Kenneth Dawson-Howe, Andrew Fitzgibbon, Craig Robertson, Emanuele Trucco and Christopher K.I. Williams, Dictionary of Computer Vision and Image Processing, 2nd Edition, WILEY Publications, 2014.

Online Resources:

1. https://computervisiononline.com
2. http://groups.csail.mit.edu/vision/courses/6.869/materials.html
3. http://www.cl.cam.ac.uk/teaching/1516/CompVision/materials.html

Course Outcomes:

After completion of the course, students will be able to

1. Define all concepts of image processing and Computer Vision.
2. Understand the various operations on images and Computer Vision.
3. Demonstrate the operations of Computer Vision like edge detection, Feature extraction, Linear Filtering.
4. Distinguish between the various operations of image analysis.
5. Decide the sequence of operations that can be applied in the process of segmentation.
6. Formulate computer vision applications and perform the operations of pattern analysis.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CE **3 0 0 3**

INTRODUCTION TO INTELLIGENT SYSTEMS

(Program Specific Elective - 1)

Prerequisites: Fundamental of Computing, Linear Algebra and Multivariable Calculus

Course Objectives:

1. A.I emphasize on solving real world problems for which solutions are difficult to express using traditional algorithmic approach.
2. To learn different knowledge representation techniques
3. To understand the different learnings Techniques of AI systems.
4. Developing systems to demonstrate intelligent behavior dealing with uncertainty.

UNIT 1: (~ 6 Lecture Hours)

Introduction: AI Problems, The Underlying Assumption, AI Techniques, Learning in Neural Networks: Perceptrons, Back-propagation Networks, Generalization, Boltzmann Machines, Applications of Neural Networks and recurrent networks.

Search Techniques: Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, hill climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

UNIT 2:(~ 11 Lecture Hours)

Knowledge Representation Issues:

Representations and Mappings, Approaches to Knowledge Representation. Issues in Knowledge Representation, The Frame problem.

Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution, Fuzzy Logic and Fuzzy Sets.

UNIT 3:(~ 10 Lecture Hours)

Constraint Satisfaction Problems: Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning.

UNIT 4:(~ 11 Lecture Hours)

Uncertain Knowledge and Reasoning: Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference using Full Join Distributions, Independence, Bayes' Rule and Its Use.

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks. Efficient Representation of Conditional Distributions, Extract Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Extending Probability to First –Order Representations, Certainty factors and Dempster-Shafer Theory of Evidential reasoning.

UNIT 5: (~ 10 Lecture Hours)

Learning: Learning from Observations, Forms of Learning, Inductive Learning, Learning Decision Trees.

Knowledge in Learning: A Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning using Relevance Information.

Statistical Learning Methods: Learning with Hidden Variables, Instance-Based Learning.

Reinforcement Learning: Introduction, Passive and Active Reinforcement Learning.

Text Books:

1. E.Rich and K. Knight, Artificial Intelligence, 2nd Edition, (TMH).
2. Stuart Russel and Peter Norvig, Artificial Intelligence – A Modern Approach, 2nd Edition, PHI/ Pearson Education.

Reference Books:

1. Luger G.F. and Stubblefield W.A. (2008), Artificial Intelligence: Structures and strategies for Complex Problem Solving, Addison Wesley, 6th Edition.
2. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

Online Resources:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
2. http://www.cs.toronto.edu/~fbacchus/csc384/Lectures/lectures.html

Course Outcomes:

After completion of the course, students will be able to

1. Able to understand knowledge of the fundamental principles of intelligent systems.
2. Select a search algorithm for different applications.
3. Understanding of Knowledge based systems.
4. Possess the skill to analyze and compare variety of AI problem solving techniques.
5. Acquire knowledge in Uncertainty and Probabilistic reasoning approaches.
6. Applying different learning techniques to solve complex problems.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CF **3 0 0 3**

AGILE SOFTWARE DEVELOPMENT

(Program Specific Elective - 2)

Prerequisites:-Nil-

Course Objectives:

1. Understand the benefits and pitfalls of agile model.
2. Acquire knowledge onagile software development practices and how small team scan apply them to create high- quality software.
3. Provide a good understanding of software design and a set of software technologies.
4. Perform detailed examination and demonstration of Agile development and testing techniques.
5. Gain knowledge on mastering agility and seek technical excellence.

UNIT 1: (~ 10 Lecture Hours)

Introduction: Agile Definition, How to be Agile, Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods, Understanding XP, Values and Principles, Improve the Process, Eliminate Waste, Deliver Value.

UNIT 2: (~ 9 Lecture Hours)

Practicing XP: Thinking, Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.

UNIT 3: (~ 10 Lecture Hours)

Releasing: Done Done, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation.

UNIT 4: (~ 10 Lecture Hours)

Planning: Vision, Release Planning, Risk Management, Iteration Planning, Stories, Estimating.

Developing: Incremental Requirements, Customer Tests, Test- Driven Development, Refactoring, Incremental Design and Architecture, Spike Solutions, Performance Optimization.

UNIT 5: (~ 9 Lecture Hours)

Mastering Agility: Values and Principles, Improve the process, Rely on People, Eliminate Waste, Deliver Value, Seek Technical Excellence

Text Books:

1. James Shore and Shane Warden, The Art of Agile Development, O'REILLY, 2007.
2. Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices, PHI, 2002.

Reference Books:

1. Craig Larman, Agile and Iterative Development: A Managers Guide, Addison- Wesley, 2004.
2. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

Online Resources:

1. https://www.coursera.org/learn/agile-project-management
2. https://WWW.Coursera.org/specializations/agile-development

Course Outcomes:

After completion of the course, students will be able to

1. Realize the importance of interacting with businesss take holders in determining the requirements for a software system.
2. Performiterative software development processes: how to planthem, how to execute them.
3. Develop techniques and tools for improving team collaboration and software quality.
4. Perform Software process improvement as an ongoing task for development teams.
5. Show how agile approaches can be scaled upto the enterprise level.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CG **3 0 0 3**

DISTRIBUTED SYSTEMS

(Program Specific Elective - 2)

Prerequisites: -Nil-

Course Objectives

1. Identify what and why a distributed system is.
2. Understand theoretical concepts, namely, virtual time, agreement and consensus protocols.
3. Understand IPC, Group Communication & RPC Concepts.
4. Understand DFS and DSM concepts.
5. Understand the concepts of transaction in distributed environment and associated concepts namely concurrency control, deadlocks and error recovery.

UNIT 1: (~ 8 Lecture Hours)

Characterization of Distributed Systems - Introduction, Examples of Distributed systems, Resource sharing and the web, Challenges.

System models - Introduction, Architectural models, Fundamental models.

UNIT 2: (~ 10 Lecture Hours)

Time and Global States - Introduction, Clocks, Events and Process states, Synchronizing physical clocks, Logical time and logical clocks, Global states.

Coordination and Agreement - Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems.

UNIT 3: (~ 10 Lecture Hours)

Inter Process Communication - Introduction, The API for the Internet Protocols, External data representation and marshalling, Client-Server communication, Group communication,

Case Study: IPC in UNIX.

Distributed objects and Remote Invocation - Introduction, Communication between distributed objects, Remote Procedure Call, Events and notifications, Case study: Java RMI.

UNIT 4: (~ 10 Lecture Hours)

Distributed File Systems - Introduction, File Service architecture, Case study 1: SUN network file system, Case study 2: The Andrew file system.

Distributed Shared Memory - Introduction, Design and Implementation issues, Sequential Consistency and IVY case study, Release Consistency, Munin Case Study, Other Consistency Models, Google case study.

UNIT 5: (~ 8 Lecture Hours)

Name Services - Introduction, Name Services and the Domain Name System, Directory Services, Case study of the Global Name Services.

Distributed Transactions - Introduction to Transactions, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Text Books:

1. George Coulouris, J Dollimore and Tim Kindberg, Distributed Systems, Concepts and Design, Pearson Education, 4th Edition, 2009.

Reference Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed systems, Principles and Paradigms, 2nd Edition, PHI, 2006.
2. Sukumar Ghosh, Distributed Systems- An Algorithm Approach, Chapman and Hall/CRC, Taylor and Fransis Group, 2007.

Online Resources:

1. https://www.smartzworld.com/notes/distributed-systems-notes-pdfds
2. http://nptel.ac.in/courses/106106107
3. https://edutainmentzone.blogspot.com › Home › DS › Education

Course Outcomes:

After completion of the course, students will be able to

1. Understand the concepts of distributed system, various system models.
2. Apply virtual time, agreement and consensus protocols in distributed systems.
3. Analyse the establishment of Inter process communication between distributed systems.
4. Comprehend and design a new distributed system with the features that support distributed file system and distributed shared memory.
5. Apply and analyse the knowledge of distributed transactions.
6. Develop new distributed applications.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CH **3 0 0 3**

ADVANCED WIRELESS AND MOBILE NETWORKS

(Program Specific Elective - 2)

Prerequisites: Computer Networks

Course Objectives:

1. Understand the wireless/mobile communications needs and challenges.
2. Familiarity with concepts of wireless networks, standards, technologies and their basic operations.
3. Design and analyse various medium access protocols.
4. Knowledge of operating system used in WSNs.

UNIT 1: (~ 9 Lecture Hours)

Wireless Transmission: Frequencies for radio transmission, Signals, Antennas, Signal Propagation, Spread Spectrum.

Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA.

UNIT 2: (~ 10 Lecture Hours)

Telecommunications System: GSM-Mobile services – System architecture, Radio interface, Protocols, Localization and calling, Handover, Security and New data service, GPRS, DECT-System architecture, Protocol architecture.

Wireless LAN: Infrared Vs Radio transmission, Infrastructure and Ad-hoc Networks, IEEE 802.11-System architecture 208, Protocol architecture, Physical layer, Medium access control layer, MAC Management, 802.11b and 802.11a.

UNIT 3: (~ 10 Lecture Hours)

Mobile IP Protocol: Introduction, Mobility Requirements & Constraints in an IP Environment, Mobile IP Protocol overview, Route Optimization, Mobility support for IPv6, Connectivity with 3G Networks, Management of Information Bases.

Transport Over Wireless Network: Introduction, Overview of TCP, TCP over Wireless Networks, Approaches to improve Transport Layer Performance.

UNIT 4: (~ 8 Lecture Hours)

Wireless Sensor Network: Basics, MAC Layer, Routing and Other Communication issues, Sensor localization, Power Management, Special WSNs, WSN application.

OS in sensors: Tiny OS for WSN.

UNIT 5: (~ 8 Lecture Hours)

Security & Fraud Detection in Mobile & Wireless Networks: Introduction, Network Security Problems, Network Security management Plan, Intrusion Detection System, Securing Data Transfer in Digital Mobile Systems, Securing Wireless Ad-hoc Networks, Authentication of Mobile Users, Subscription & Fraud Detection in Mobile Phone Systems.

Wireless PANs: Bluetooth and Zigbee.

Text Books:

1. Schiller J., Mobile Communications, Addison Wesley, 2000.
2. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc., 2002.
3. Fei Hu and Xianojun Cao, Wireless Sensor Networks Principles & Practice.

Reference Books:

1. Stallings W, Wireless Communications and Networks, Pearson Education, 2005.
2. Raj Kamal, Mobile Computing, Oxford publisher, 2nd Edition, 2015.

Online Resources:

1. https://learningnetwork.cisco.com/commUNITy/certifications/wireless_ccna/wifund/study-material

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge of various types of wireless networks, standards, operations and use cases.
2. Design WLAN, WPAN and Cellular based upon underlying propagation.
3. Demonstrate knowledge of protocols used in wireless networks.
4. Discuss the underlying Operating System for Wireless Sensor Networks.
5. Analyse the wireless networks trade-offs between wired and wireless links.
6. Understand the security issues in Mobile & Wireless networks.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 52130 **0 0 3 1.5**

ADVANCED DATA STRUCTURES LAB

Prerequisites: Data Structures

Course Objectives:

1. Write and execute programs in Java to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, hash tables and search trees.
2. Learn to implement various text processing & computational geometry algorithms.

List of Programs:

WEEK 1:

Write Java programs to implement the following using an array.

a) Stack ADT b) Queue ADT

Week 2:

Write Java programs to implement the following using a singly linked list.

a) Stack ADT b) Queue ADT

Week 3:

Write a Java program to implement priority queue ADT.

Week 4:

Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.

a) Linear Probing b) Quadratic Probing

Week 5:

Write a Java program to perform the following operations.

a) Construct a SKIPLIST b) Search
c) Update Operation on Skip Lists

Week 6:

Write a Java program to perform the following operations.

a) Construct a binary search tree of elements.
b) Search for a key element in the above binary search tree.
c) Delete an element from the above binary search tree.

Week 7:

Write a Java program to perform the following operations

a) Insertion into a B-tree. b) Deletion from a B-tree.

Week 8:

Write a Java program to perform the following operations

a) Insertion into an AVL-tree. b) Deletion from an AVL-tree.

Week 9:

a) Write a Java program that implements Brute-Force algorithm for pattern matching.

b) Write a Java program that implements Boyer Moore algorithm.

Week 10:

Write a Java program that implements KMP algorithm for pattern matching.

Week 11:

Write a Java program to implement following algorithms:

a) Huffman coding b) Longest Common Subsequence Problem

Week 12:

Write a Java program to perform the following operations:

a) Constructing a Quad Tree b) Searching a Quad Tree

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in JAVA, 3rd Edition, Pearson, 2012.
2. M T Goodrich and Roberto Tamassia, Algorithm Design, John Wiley, 2006.

Reference Books:

1. S.Sahni, Data structures, Algorithms and Applications in Java, 2nd Edition, Universities Press, 2005.
2. A.Drozdek, Data Structures and Algorithms in java, 3rd Edition, Cengage Learning, 2008.
3. J.R.Hubbard, Data Structures with Java, 2nd Edition, Schaum's Outlines, TMH, 2007.

Online Resources:

1. https://www.hackerrank.com
2. https://www.cdn.geeksforgeeks.org/advanced-data-structures/
3. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php

Course Outcomes:

After completion of the course, students will be able to

1. Execute the programs for various data structures like stacks & queues.
2. Develop the programs for various non-linear data structures as linked lists, binary search tree, AVL tree and B-tree.
3. Build the programs for various advanced data structures for dictionaries etc.
4. Implement various text processing algorithms.
5. Solve algorithms for computational geometry.

I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 52131 **0 0 3 1.5**

DEEP LEARNING LAB

(Program Specific Elective - 1)

Prerequisites: Introduction to Machine Learning

Course Objectives:

1. To understand the basics of deep learning and regularization for deep learning.
2. Explore the methods to develop optimized deep learning networks considering hyper parameters.
3. To acquire the knowledge of recurrent and recursive nets.
4. Model solutions for real life problems using Convolution neural networks and recursive Neural Networks.

List of Experiments:

1. Setting up the Spyder/Jupyter IDE Environment and Executing a Python Program.
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them.
3. Build a model that takes an image as input and determines whether the image contains a picture of a dog or a cat using Convolutional Neural Networks (CNN).
4. Write a program for Image classification on MNIST dataset with the help of CNN model fully connected layer.
5. Write a program to diagnosis heart patients using standard Heart Disease Data Set. You can use Python library classes/API.
6. Use CIFAR-10 dataset and build an image classification model that will be able to identify what class the input image belongs to.
7. Implement a Human Face Recognition Model and determine the accuracy in detecting the bounding boxes of the human face.
8. Build an image classification model to detect if the person has cancer or not.
9. Build a chatbot to identify the context the user is asking and then provide it with the relevant.
10. Train a sentiment analysis model on IMDB dataset using RNN LSTM

Text Book:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning -MIT Press book, 2016.

Reference Books:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations and Trends® in Signal Processing, Volume 7, Issues 3-4, ISSN: 1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science, Create Space Independent Publishing Platform (January 10, 2016).
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learning with R Version 1, Copyright 2017 Manning Publications.

Online Resources:

1. https://www.coursera.org/learn/neural-networks-deep-learning
2. https://www.deeplearning.ai/program/deep-learning-specialization/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental principles of Deep Learning.
2. Understand and apply regularization for deep learning neural networks.
3. Use optimization techniques for training deep models.
4. Gain knowledge on the basics and architecture of Convolution neural networks.
5. Explore different recurrent neural networks with architecture.
6. Implement deep learning algorithms and solve real-world problems.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 52132 **0 0 3 1.5**

COMPUTER VISION LAB

(Program Specific Elective - 1)

Prerequisites:-Nil-

Course Objectives:

1. Make students acquainted with practical aspects of computing with images.
2. Improving quality of image by applying enhancement techniques.
3. Exstract features using Histogram processing, Color, Edges, Texture.
4. Apply mathematical morphological operations based on shapes.
5. Implement various pattern analysis techniques.

List of Experiments:
Use any tool like Open CV/ Scilab/ R Programming etc.

Week 1:
Familiarization of the tool used for computer vision.

Week 2:
Write programs for the following
a. Loading and displaying an image. b. Reading and writing video files.
c. Image enhancement.

Week 3:
Write a program to smooth an image using
a. Gaussian filter b. Median filter

Week 4:
Apply morphological operations like dilation, erosion, opening and closing on the given image.

Week 5:
Write a program for edge detection using different edge detection masks.

Week 6:
Implement histogram calculation and equalization for the given image.

Week 7:
Convert the input image from RGB color space to CMY and HSV color space.

Week 8:
Write a program for texture feature extraction of a given image.

Week 9:
Apply Hough transformation on the given image to detect lines.

Week 10:
Write a program to segment an image by K-Means clustering.

Week 11:
Classify the given images using Naïve Bayesian classifier.

Week 12:
Write a program to reduce dimensionality using PCA for the given images.

Text Books:
1. Gary Bradski and Adrian Kaehler, Learning OpenCV, 1st Edition, O'Reilly Media, Inc., 2008.
2. Talita Perciano, Alejandro C Frery, Introduction to Image Processing Using R: Learning by Examples, Springer, 1st Edition, 2013.

Reference Books:
1. R C Gonzalez and R E woods, Digital Image Processing, Addison Pearson, 3rd Edition, 2013.
2. David A.Forsyth, Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.

Online Resources:
1. https://atoms.scilab.org/toolboxes/IPCV/1.1
2. https://docs.opencv.org/2.4/doc/tutorials/tutorials.html

Course Outcomes:
After completion of the course, students will be able to
1. Understand the basic image processing techniques and enhance images by adjusting contrast.
2. Detect edges using various kernels, detect lines using Hough transformation.
3. Apply histogram processing, convert between various colour spaces and obtain texture.
4. Analyze the morphological operations erosion, dilation, opening and closing.
5. Partition dataset by classification and clustering.
6. Comprehend computer vision system for real world problems.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 52133 **0 0 3 1.5**

INTRODUCTION TO INTELLIGENT SYSTEMS LAB

(Program Specific Elective - 1)

Prerequisites: -Nil-

Course Objectives:

1. Design and analyse various computing algorithms and techniques using Python/Scilab.
2. Able to apply different learning algorithms to solve real time problems.
3. Recognize the underlying mathematics and logic behind various AI techniques.

List of Experiments

Implement the following programs using Python/Scilab language.

Implementation of basic programs

Week 1:

a. Program to reverse a given number.
b. Program to check whether given year is a leap year or not.
c. Program to form a new string made of the first 2 characters and last 2 characters from a given string.
d. Program to count the number of vowels present in a string.
e. Program that reads a text file and counts the number of times a certain letter appears in the text file.

Week 2:

Write a program for implementing search methods

a. Breath-First Search. b. Depth-First Search.

Week 3:

Program for implementing Heuristic search algorithm.

Week 4:

Write a program to convert a crisp set to fuzzy set.

Week 5:

Implement the Constraint Satisfaction problem using backtracking.

Week 6:

Write a program for implementation of Adversarial search.

Week 7:

Implement the Multilayer Perceptron Neural Network.

Week 8:
Write a program to implement Backpropagation algorithm of ANN.

Week 9:
Program for implementing Recurrent Networks.

Week 10:
Write a program to implement Bayesian and Bayes algorithm.

Week 11:
Write a program which gives the fittest value of the target using Genetic algorithm.

Week 12:
Implementation of any case study using AI techniques.

Text Books:
1. Prateek Joshi, Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt publishing, January2017.

Reference Books:
1. Prateek Joshi, Artificial Intelligence with Python – Heuristic Search [Video], PACKT,2017.
2. Nilsson, Artificial Intelligence:A New Synthesis Paper back Elsevier India, 1st Edition, July2003.

Online Resources:
1. https://www.researchgate.net/file.PostFileLoader.html?id...assetKey..
2. http://artint.info/AIPython/aipython.pdf

Course Outcomes:
After completion of the course, student will be able to
1. Write programs in Python/Scilab language.
2. Design different Artificial Neural Network models for solving real time problems.
3. Implement and apply fuzzy logic and reasoning to solve various engineering problems.
4. Apply genetic algorithms for finding the fittest value of the target.
5. Recognize the underlying mathematics and logic behind various computing algorithms under AI System.
6. Apply variety of learning algorithms to solve problems of moderate complexity.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521CJ **2 0 0 2**

RESEARCH METHODOLOGY AND IPR

Prerequisites: English

Course Objectives:

1. To develop an understanding of IPR/ research methodology in the process of creation of patents through research.
2. To develop further researchcapabilities.

UNIT 1: (~7 Lecture Hours)
Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Methods, Importance of Research Methodology, Research Process, Criteria of Good Research.

UNIT 2: (~6 Lecture Hours)
Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes, Data collection methods, Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data.

UNIT 3: (~5 Lecture Hours)
Research Report Writing: Format of the Research report, Synopsis, Dissertation, References/Bibliography/ Webliography, Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal. Introduction to the use of software tools: Grammarly, Overleaf and References function in Microsoft word.

UNIT 4: (~5 Lecture Hours)
Nature of Intellectual Property: Patents, Designs, Trademarks and Copyrights. Process of Patenting and Development: technological research, innovation.

UNIT 5: (~8 Lecture Hours)
Patent Rights: Scope of Patent Rights, Licensing and transfer of technology. Patent information and databases. New Developments in IPR: Administration of Patent System.

Text Books:

1. C.R Kothari, Research Methodology, Methods & Technique, New Age International Publishers, 2004.
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011.
3. Robert P. Merges, Peter S. Menell and Mark A. Lemley, Intellectual Property in New Technological Age, 2016.
4. T. Ramappa, Intellectual Property Rights Under WTO, S. Chand, 2008.
5. Satarkar, S.V., Intellectual property rights and copy right, ESS Publications, 2000.

Reference Books:

1. Ranjit Kumar, Research Methodology: A Step by Step Guide for beginners, 2nd Edition, 2012.
2. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd, 2007.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_hs55
   (Course Title: Patent Law for Engineers and Scientists, by Dr. Feroz Ali (IIT Madras))
2. https://onlinecourses.nptel.ac.in/noc20_hs54
   (Course Title: Patent Drafting for Beginners, by Dr. Feroz Ali (IIT Madras))

Course Outcomes:

After completion of the course, student will be able to

1. Describe research problem formulation and outline the Research Design process.
2. Identify the various methods of Data Collection.
3. Demonstrate the ability to draft Research Report, Synopsis and Dissertation with appropriate Bibliography/ Webliography while conforming to research ethics.
4. Categorize various forms of Intellectual Property and list out the steps involved in Patenting.
5. Justify the need for Patenting and Transfer of Technology in the socio-economic growth of the society.
6. Develop a Research Proposal and Research Grant Proposal.

I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CK **3 0 0 3**

ADVANCED ALGORITHMS

Prerequisites: Advanced Data Structures

Course Objectives:

1. Introduce advanced methods of designing and analyzing algorithms.
2. Choose appropriate algorithms and use it for a specific problem.
3. Familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Introduce the recent developments in algorithmic design.

UNIT 1: (~ 10 Lecture Hours)

The Role of Algorithms in Computing: Algorithms, Algorithms as a technology.

Searching & Sorting- Linear search and Binary search, Internal and External sorting, Insertion Sort, Heap Sort, Quick Sort, Topological sorting, Time/space analysis.

UNIT 2: (~ 10 Lecture Hours)

Graph: Elementary Graph Algorithms, MST, Single-Source Shortest Path, All Pair Shortest Path.

Maximum Flow: Flow Networks, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

UNIT 3: (~ 8 Lecture Hours)

Divide-and-Conquer: Introduction, The Maximum-subarray problem, Stassen's algorithm for matrix multiplication, Substitution Method, Recurrence –Tree Method, Master Method, Proof of Master Theorem.

UNIT 4: (~9 Lecture Hours)

Dynamic Programming: Rod Cutting, Matrix Chain Multiplication, Elements of dynamic programming, longest common subsequence, Optimal binary search tree.

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

UNIT 5: (~ 8 Lecture Hours)

String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata.

NP Completeness: Polynomial time, Polynomial time verification, NP Completeness and reducibility, NP Complete Problems.

Text Book:

1. Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, 3rd Edition, MIT Press, 1990.

Reference Books:

1. Mark A. Weiss, Data Structures and Algorithm Analysis in Java, 3rd Edition, Pearson, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, 1st Edition, Addison-Wesley Publication, 1974.

Online Resources:

1. http://nptel.ac.in/courses/106104019/
2. https://www.coursera.org/learn/advanced-algorithms-and-complexity
3. https://www.udemy.com/course/advanced-algorithms-in-java/

Course Outcomes:

After completion of the course, students will be able to

1. Design efficient algorithms for any complex real world problems.
2. Analyze the complexity/performance of different algorithms.
3. Assessing data using graphs and flow networks in various applications.
4. Apply different designing methods such as divide and conquer, dynamic programming and greedy methods, for development of algorithms to realistic problems.
5. Formulate algorithms for NP hard and NP complete problems.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CL **3 0 0 3**

SOFT COMPUTING

Prerequisites: -Nil-

Course Objectives:

1. Introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. Implement soft computing based solutions for real-world problems.
3. Give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic and genetic algorithms.
4. Analyze and Apply Genetic Algorithms to combinatorial optimization problems.

UNIT 1: (~ 7 Lecture Hours)

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics: Supervised, Unsupervised and Reinforcement Learning.

UNIT 2: (~ 10 Lecture Hours)

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Defuzzification, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making, Study of fuzzy logic toolbox.

UNIT 3: (~ 11 Lecture Hours)

Neural Networks: Machine Learning using Neural Network Basics. Supervised Learning Neural Networks: Introduction, Perceptrons, Adaline, Backpropagation Multilayer Perceptrons, Radial Basis Function Networks, Modular Networks, Study of Neural Network toolbox.

Adaptive Networks: Architecture, Backpropagation for Feed forward Networks, Extended Backpropagation for Recurrent Networks, Hybrid Learning Rule.

UNIT 4: (~10 Lecture Hours)

Advanced Neural Networks Unsupervised Learning Neural Networks: Introduction, Competitive Learning Networks, Kohonen Self-Organizing Networks, Hebbian Learning, Principal Component Networks, Hopfield Networks.

Reinforcement Learning: Q-Learning, Simple implementation of Artificial Neural Network and Fuzzy Logic.

UNIT 5: (~ 10 Lecture Hours)

Genetic Algorithms(GA): Introduction, Biological Background, Traditional optimization and search techniques, Search Space, Genetic Algorithm(GA) Vs Traditional Algorithms, Basic Terminologies, Simple and General GA, Operators in GA, Stopping Condition for GA flow, Problem solving using GA, Classification of GA's: Messy, Adaptive, Hybrid and parallel. Applications of GA.

Text Books:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun and EijiMizutani, Neuro Fuzzy and Soft Computing, Prentice Hall of India/PHI, 2003.
2. S.N Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007.

Reference Books:

1. David E Goldberg, Genetic Algorithms in Search Optimization and machine learning, Addison-Wesley, 1989.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
3. Russell and Norvig, Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.

Online Resources:

1. www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf
2. https://drive.google.com/file/d/0B0z1V-RAPGVkT2MyTXlwdE9XWXc/view?usp=sharing
3. https://github.com/rohanchikorde/Data-Science-books/blob/master/python-machine-learning-2nd.pdf
4. http://www.myreaders.info/html/soft_computing.html

Course Outcome:

After completion of the course, students will be able to

1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Understand and apply concept of artificial neural networks.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
4. Apply genetic algorithms to combinatorial optimization problems.
5. Evaluate and compare solutions by various soft computing approaches for a given problem.
6. Recognize the underlying mathematics and logic behind various soft computing algorithms.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CM **3 0 0 3**

DATA SCIENCE

(Program Specific Elective - 3)

Prerequisites: Database Management Systems

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Provide Python code to statistically analyze a dataset.
4. Critically evaluate data visualization based on their design and use for communicating stories from data.

UNIT 1: (~ 8 Lecture Hours)

Introduction: Big Data and Data Science Hype, History of past and current, A Data Science Profile, Meta-Definition, Statistical Thinking, Exploratory Data Analysis, The Data Science Process, Case Study: Real Direct.

UNIT 2: (~ 10 Lecture Hours)

Algorithms: Machine Learning Algorithms, Three Basic Algorithms, Exercise: Basic Machine, Learning Algorithms.

Spam Filters, Naive Bayes, and Wrangling: Learning by Example, Naïve Bayes, Laplace Smoothing, Comparing Naive Bayes to KNN, Sample Code in bash, Scraping the Web: APIs and Other Tools.

UNIT 3: (~ 10 Lecture Hours)

Logistic Regression: Thought Experiments, Classifiers, M6D Logistic Regression Case Study, Media 6 Degrees Exercise.

Extracting Meaning from Data: William Cukierski, The Kaggle Model, Ethical Implications of a Robo-Grader, Feature Selection, Google's Hybrid Approach to Social Research.

UNIT 4: (~10 Lecture Hours)

Data Visualisation Techniques: Data Visualization History, Types of Visualization, Characteristics, Encoding schemes, Mapping variables to encodings, Visual encodings.

Data Leakage and Model Evaluation: Claudia's Data Scientist Profile, Data Mining Competitions, Characteristics of Good Modeler, Data Leakage, Avoid Leakage, Evaluating Models.

UNIT 5: (~ 8 Lecture Hours)

Applications of Data Science: Recent trends in various data collections, analysis techniques, Visualizing techniques, application development methods (implementation in Python).

Text Books:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Publishers, 2013.
2. Samir Madhavan, Mastering Python for Data Science, Packt Publishing, 2015.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets, v2.1, Cambridge University Press.
2. Foster Provost and Tom Fawcett, Data Science for Business, What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly.

Online Resources:

1. http://datasciencemasters.org/.
2. http://learnds.com/
3. https://www.datascienceweekly.org/

Course Outcomes:

After completion of the course, students will be able to

1. Understand and apply suitable algorithms for data science.
2. Compare various techniques and use appropriate methods for given data set.
3. Design suitable models to extract useful information for the given data.
4. Present the data using suitable visualization methods.
5. Handle data leakage problems in data.
6. Analyze various hypothesis for better understanding.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CN **3 0 0 3**

NETWORK SECURITY

(Program Specific Elective 3)

Prerequisites: Computer Networks

Course Objectives:

1. Understand basics of Cryptography and Network Security.
2. Secure a message over insecure channel by various means.
3. Acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
4. Understand the various key distribution and management schemes.
5. Knowledge on IP Security and Email Security.
6. Understand the Security Standards of Web and Wireless Network Security.

UNIT 1: (~9 Lecture Hours)

Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines,Steganography.

UNIT 2: (~9 Lecture Hours)

Block Ciphers and the Data Encryption Standard: Tradition Block Cipher Structure, DES, Strength of DES,Block Cipher Design Principles.

Advanced Encryption Standard: AES structure, AES Transformation Functions, AES Key expansion.

Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook, Cipher Block Chaining Mode, Cipher Feedback Mode.

Random Bit Generation and Stream Ciphers: Principles of Pseudorandom Number Generation,

Pseudorandom Number Generators,Pseudorandom Number Generation Using a Block Cipher,Stream Ciphers,RC4.

UNIT 3: (~9 Lecture Hours)

Public Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key exchange.

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Two simple Hash functions, Requirements and Security, SHA.

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes,MACs Based on Hash functions: HMAC.

Digital Signatures: Digital Signatures, NIST Digital Signature Algorithm.

UNIT 4: (~10 Lecture Hours)

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates.

User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos

Transport-Level Security: Web Security Considerations, Transport Layer Security, HTTPs.

UNIT 5: (~8 Lecture Hours)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy.

IP Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

Text Books:

1. William Stallings, Cryptography and Network Security, 7th Edition, 2017 Pearson Education
2. AtulKahate, Cryptography and Network Security, 3rd Edition, McGraw Hill Education.

Reference Books:

1. Behrouz A.Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, 2015 McGraw Hill Education.
2. Bernard Menezes, Network Security and Cryptography, CENGAGE Learning.

Online Resources:

1. https://www.tutorialspoint.com/information_security_cyber_law/ network_security.htm
2. http://scitechconnect.elsevier.com/wp-content/uploads/2013/09/Network-Security-Basics.pdf
3. https://alison.com/course/introduction-to-computer-network-security
4. https://online.stanford.edu/course/network-security

Course Outcomes:

After completion of the course, students will be able to

1. Identify the security issues in the network and resolve it.
2. Understand the different threats & design the various encryption algorithms.
3. Analyze the public key cryptographic systems and key distribution techniques.
4. Choose the appropriate authentication algorithms.
5. Demonstrate the various network application security schemes.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CP **3 0 0 3**

BIG DATA ANALYTICS

(Program Specific Elective - 3)

Prerequisites: Data Structures, Computer Organization

Course Objectives:

1. Understand big data for business intelligence.
2. Learn business case studies for big data analytics.
3. Understand NoSQL big data management.
4. Understand map-reduce analytics using Hadoop and related tools.

UNIT 1: (~ 9 Lecture Hours)

What is Big Data, Why Big Data: Convergence of Key Trends, Unstructured Data.

Industry Examples of Big Data: Web Analytics, Big Data and Marketing, Fraud and Big Data, Risk and Big Data, Credit Risk Management, Big Data and Algorithmic Trading, Big Data and Healthcare, Big Data in Medicine, Advertising and Big Data.

Big Data Technologies: Introduction to Hadoop, Open Source Technologies, Cloud and Big Data, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics.

UNIT 2: (~ 8 Lecture Hours)

NoSQL: Introduction to NoSQL, Aggregate Data Models, Aggregates, Key-Value and Document Data Models, Relationships, Graph Databases, Schemaless Databases, Materialized Views.

Distribution Models: Sharding, Master-Slave Replication, Peer-Peer Replication, Sharding and Replication, Consistency, Relaxing Consistency, Version Stamps.

UNIT 3: (~ 10 Lecture Hours)

MapReduce: Partitioning and Combining, Composing Map-Reduce Calculations, Data Format, Analyzing Data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Pipes.

Hadoop Distributed File System: Design of Hadoop Distributed File System (HDFS), HDFS Concepts, Java Interface, Data Flow.

Hadoop I/O:Data Integrity, Compression, Serialization, Avro, File-Based Data Structures.

UNIT 4: (~ 9 Lecture Hours)

Developing A Mapreduce Application: Mapreduce Workflows, UNIT Tests with MRUNIT, Running Locally on Test Data.

How Mapreduce Works: Anatomy of Mapreduce Job Run, Classic Map-Reduce, Yarn, Failures in Classic Map-Reduce and Yarn, Job Scheduling, Shuffle and Sort, Task Execution.

MapReduce Types and Formats: Input Formats, Output Formats.

UNIT 5: (~ 9 Lecture Hours)

Hbase: Data Model and Implementations, Hbase Clients, Hbase Examples, Praxis.

Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User Defined Functions.

Pig: Grunt, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, Big Data, Big Analytics, John Wiley & Sons, Inc.2013.
2. P.J Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012.
3. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilley, 2012.

Reference Books:

1. Eric Sammer, Hadoop Operations, O'Reilley, 2012.
2. Lars George, HBase: The Definitive Guide, O'Reilley, 2011.
3. Alan Gates, Programming Pig, O'Reilley, 2011.
4. Jason Rutherglen, Dean Wampler and Edward Capriolo, Programming Hive, O'Reilley, 2012.

Online Resources:

1. https://www.tutorialspoint.com/hadoop/index.htm
2. https://www.tutorialspoint.com/hive/index.htm
3. https://www.tutorialspoint.com/hbase/index.htm
4. https://www.tutorialspoint.com/apache_pig/index.htm

Course Outcomes:

After completion of the course, students will be able to

1. Describe big data and use cases from selected business domains.
2. Understand NoSQL big data management and various distribution models.
3. Understand the design of HDFS and Hadoop I/O.
4. Understand map-reduce analytics using Hadoop.
5. Understand Hadoop related database tools such as HBase and Hive.
6. Write Pig Scripts for Big Data Analytics.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CQ **3 0 0 3**

DISTRIBUTED DATABASES

(Program Specific Elective - 4)

Prerequisites: Database Management Systems

Course Objectives:

1. The objective of the course is to learn the management of distributed data using distributed database management systems.
2. To acquire insight into difference between the centralized databases and distributed databases.
3. Understand distributed DBMS architecture, query decomposition and data localization.
4. Learn the techniques of transaction management, distributed concurrency control, client/server architectures and distributed multi-DBMSs.

UNIT 1: (~ 8 Lecture Hours)

Distributed Databases: 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 2: (~ 9 Lecture Hours)

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 3: (~ 10 Lecture Hours)

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 4: (~ 9 lectures)

Reliability: Basic Concepts, Nonblocking 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 5: (~ 10 Lecture Hours)

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. Stefano Ceri and Giuseppe Pelagatti, Distributed Databases Principles & Systems, TMH.1985.
2. M. Tamer Ozsu and Patrick Valduriez, Principles of Distributed Database Systems, Pearson Education, 2nd Edition.

Reference Books:

1. Chhanda Ray and Ray, Distributed Database Systems, Pearson education India, 2009.
2. Saeed K.Rahimi and Frank S.Haug, Distributed Database Management System-A Practical Approach, Wiley Publisher, 2010.

Online Resources:

1. http://pcbunn.cithep.caltech.edu/DistributedDatabasesPakistan.pdf
2. http://web.cs.wpi.edu/~cs561/s12/LectureHours/4-5/DistributedDBs.pdf
3. https://www.tutorialspoint.com

Course Outcomes:

After completion of the course, students will be able to

1. Differentiate key concepts and techniques for centralized databases and distributed databases.
2. Analyze and design distributed database systems based on the principles of distributed indexing, query evaluation, data replication.
3. Implement storage, indexing, query evaluation and query optimization techniques.
4. Implement the concepts of transaction management, concurrency control, crash recovery, deadlocks and catalog management.
5. Apply suitable architecture for distributed databases.
6. Understand the concepts of distributed object database management systems.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CR **3 0 0 3**

COMPILER FOR HPC

(Program Specific Elective 4)

Prerequisites: Computer Organization, Compiler Design

Course Objectives:

1. The objective of this course is to introduce structure of high performance compilers.
2. Student will learn to design a compiler that run efficiently in terms of space and time.
3. Have knowledge of cache coherence and parallel loops in modern compilers.

UNIT 1: (~ 9 Lecture Hours)
High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.
Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored.

UNIT 2: (~ 8 Lecture Hours)
Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars, Data Dependence Analysis for Arrays.
Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

UNIT 3: (~ 14 Lecture Hours)
Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-Procedural Transformations.
Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.
Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers.

UNIT 4: (~ 10 Lecture Hours)
Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from all Loops, Nested Loops, Round off Error, Exceptions and Debuggers, Multi-vector Computers.
Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics.

UNIT 5: (~ 7 Lecture Hours)
Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.
Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

Text Book:

1. Michael Wolfe, High-Performance compilers for Parallel Computing, Pearson, 1995.

Online Resources:

1. www.springer.com/gp/book/9783540280095
2. www.chpc.utah.edu/documentation/software/compilers.php

Course Outcomes:

After completion of the course, students will be able to

1. Understand the structure and working principle of compilers.
2. Handle exceptions and debugging in compilers.
3. Analyze data dependencies across various different data structures.
4. Design global optimizing techniques.
5. Use different message passing mechanisms.
6. Apply the concepts of scalable shared memory in designing compilers for high performance computing.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 522CS **3 0 0 3**

RECOMMENDER SYSTEMS

(Program Specific Elective - 4)

Prerequisites: Introduction to Machine Learning

Course Objectives:

1. To provide students with basic concepts and its application in various domain.
2. To make the students understand different techniques of recommender system that a data scientist needs to know for analyzing big data.
3. To design and build a complete machine learning solution in many application domains.

UNIT 1: (~ 8 Lecture Hours)

Introduction to recommender systems (RSs): Introduction, recommendation techniques, Application and Evaluation, recommender system as a multi-disciplinary field, emerging topics and challenges, Data mining methods for recommender systems: similarity measures, classification, Bayesian classifiers, SVMs, ensembles of classifiers, cluster analysis.

UNIT 2: (~ 8 Lecture Hours)

Collaborative Recommendation: User based nearest neighbour recommendation, item based nearest neighbour recommendation, about ratings, further model-based and pre-processing-based approaches, recent practical approaches and systems.

UNIT 3: (~ 10 Lecture Hours)

Content-based recommendation: Content representation and content similarity, Similarity-based retrieval, other text classification methods.

Knowledge based Recommendations: Introduction, knowledge representing and reasoning, interacting with constraint-based recommenders, interacting with case-based recommenders

UNIT 4: (~ 9 Lecture Hours)

Hybrid Recommender Systems: Opportunities for hybridization, monolithic hybridization design, parallelized hybridization design, pipelined hybridization design.

UNIT 5: (~ 9 Lecture Hours)

Evaluating Recommender System: Introduction, General properties of evaluation research, popular evaluation designs, evaluation on historical datasets.

Text Books:

1. Jannach D, Zanker M and FelFering A, Recommender Systems: An Introduction, Cambridge University Press, 1st Edition, 2011.
2. Ricci F, Rokach L, Shapira D and Kantor B.P, Recommender Systems Handbook, Springer, 1st Edition, 2011.

Reference Books:

1. Manouselis N, Drachsler H, Verbert K and Duval E, Recommender Systems for Learning, Springer, 1st Edition, 2013.
2. J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Edition, Cambridge, 2012 (Chapter 9).
3. M. Chiang, Networking Life, Cambridge, 2010 (Chapter 4).

Online Resources:

1. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://infolab.stanford.edu/~ullman/mmds/ch9.pdf
2. https://theaisummer.com/recommendation-systems/
3. https://www.nvidia.com/en-us/glossary/data-science/recommendation-system/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the various techniques related to personalization and recommendations.
2. To apply suitable methods for recommender systems.
3. Able to compare the advantages and limitations of different techniques used for building a recommender system.
4. Acquire knowledge on content-based and knowledge-based recommendations.
5. Able to use suitable evaluation designs for recommender systems.
6. Acquire knowledge on hybrid approaches for using existing technique.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 52236 **0 0 3 1.5**

ADVANCED ALGORITHMS LAB

Prerequisites: Programming for Problem Solving

Course Objectives:
1. Write and execute programs in Java to implement advanced algorithms.
2. Choose an appropriate design paradigm to solve problems.

List of Programs:

Week 1:
Write Java programs to implement the following using arrays or linked list:
a. Stack b. Queue

Week 2:
Write Java programs to implement and analyze the Quicksort.

Week 3:
Write Java programs to implement and analyze the Heapsort.

Week 4:
Write a Java program to implement the following:
a. Prim's Algorithm b. Kruskal's Algorithms

Week 5:
Write a Java program to implement the functions following:
a. Single-Source Shortest Path b. All Pairs Shortest Path

Week 6:
Write a Java program to analyse the Edmond-karp Algorithm.

Week 7:
Write a Java program to implement the following:
a. Maximum Sub-array problem b. Strassen's Matrix Multiplication

Week 8:
Write a Java program to implement the following:
a. Rod cutting b. Longest Common Subsequence.

Week 9:
Write a Java program to implement the Matrix Chain Multiplication.

Week 10:
Write a Java program that implements Optimal Binary Search Tree (OBST).

Week 11:
Write a Java program that implements the Huffman codes.

Week 12:
Write a Java program to implement Rabin-Karp Algorithm.

Text Books:
1. Mark A. Weiss, Data Structures and Algorithm Analysis in Java, 3rd Edition, Pearson, 2012.
2. Aho, Hopcroft and Ullman, The Design and Analysis of Computer Algorithms, 1st Edition, Addison-Wesley Publication, 1974.
3. Jon Kleinberg and Eva Tardos, Algorithm Design, 1st Edition, Pearson, 2006.
4. SartajSahni, Data Structures, Algorithms and Applications in JAVA, 2nd Edition, Universities Press, 2005.

Online Resources:
1. https://www.hackerrank.com
2. https://codetantra.com

Course Outcomes:
After completion of the course, students will be able to
1. Analyze and implement advanced sorting and searching techniques.
2. Implement various applications related to graphs and flow networks
3. Solve problems related to divide and conquer strategy.
4. Develop the dynamic programming algorithms and analyze.
5. Apply different designing methods for development of algorithms to realistic problems using greedy method.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 52237 **0 0 3 1.5**

DATA SCIENCE LAB

(Program Specific Elective - 3)

Prerequisites: -Nil-

Course Objectives:

1. Understand exploratory data analysis using R Tool.
2. Analyze the data science problems with suitable algorithms and techniques.
3. Understand the significance of classification, clustering and regression models.
4. Understand and select appropriate data science model to find hidden patters in the datasets.

List of Experiments:

Week 1:
Exploratory data analysis by using R tool.

Week 2:
Basic Statistics and Visualization in R.

Week 3:
Implementation of Association rules on transactional dataset in R.

Week 4:
Implementation of Decision tree classification and k-means clustering in R.

Week 5:
Implementation of Linear regression and Logistic regression in R.

Week 6:
Implementation of ensemble classifiers in R.

Week 7:
Practice on Python basic data types, Numpy and Pandas libraries.

Week 8:
Practice on Matplotlib and Scikit learn python libraries.

Week 9:
Implementation of Data preprocessing techniques on diabetes dataset in python.

Week 10:
Implementation of Naïve bayes classifier and SVM classifier in Python

Week 11:
Implementation of SVM and random forest algorithms on real-time datasets.

Week 12:
Implementation of data science case study as a mini-project.

Text Books:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Publishers, 2013.
2. Samir Madhavan, Mastering Python for Data Science, Packt Publishing, 2015.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets, v2.1, Cambridge University Press.
2. Foster Provost and Tom Fawcett, Data Science for Business, What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly.

Online Resources:

1. http://datasciencemasters.org/.
2. https://nptel.ac.in/courses/106106179
3. https://www.datascienceweekly.org/

Course Outcomes:

After completion of the course, students will be able to

1. Examine the process for importing and exporting the data.
2. Apply appropriate data collection and pre-processing methods.
3. Identify different data analysis Techniques suitable for a given application.
4. Demonstrate advanced data visualization techniques for Data Analysis.
5. Implement supervised, unsupervised techniques on real-time datasets.
6. Solve data science problems by using ensemble classifiers and regression techniques.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 52238 **0 0 3 1.5**

NETWORK SECURITY LAB

(Program Specific Elective - 3)

Prerequisites: -Nil-

Course Objectives:

1. Understand various network security aspects.
2. Implement various cryptographic algorithms.
3. Implement authentication and digital signatures Algorithms.

List of Experiments:

Week 1:

Implement encryption and decryption using following techniques

a. Ceaser Cipher b. Playfair Cipher

Week 2:

Implement encryption and decryption using following techniques

a. Hill Cipher b. Rail Fence, Row & Column Transformation.

Week 3:

Implement DES algorithm.

Week 4:

Implement AES algorithm.

Week 5:

Implement Cipher Block Modes of operation

a. Electronic Code Book b. Cipher Block Chaining

Week 6:

Implement RC4 algorithm.

Week 7:

Implement RSA algorithm.

Week 8:

Implement the Diffie-Hellman Key Exchange mechanism.

Week 9:

Calculate the message digest of a text using the SHA-512 algorithm.

Week 10:
Write a program in java, which performs a Digital Signature on a given text.

Week 11:
Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).

Week 12:
Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome).

Week 13:
Study of different types of vulnerabilities for hacking a websites / Web Applications.

Week 14:
Analysis the Security Vulnerabilities of E-commerce services.

Week 15:
Analysis the security vulnerabilities of E-Mail Application.

Text Books:
1. William Stallings, Cryptography and Network Security, 7th Edition, 2017 Pearson Education

Reference Books:
1. Behrouz A.Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, 2015 McGraw Hill Education.
2. Michael Gregg, Build your own Security Lab, Wiley India.

Online Resources:
1. https://www.cybrary.it/catalog
2. http://cse.iitd.ernet.in/~murali/crypt
3. https://csrc.nist.gov/projects/block-cipher-techniques
4. https://www.udemy.com/build-your-own-cyber-lab-at-home
5. https://www.cyderaces.org/tutorials

Course Outcomes:
After completion of the course, students will be able to
1. Design & Develop various Substitution and Transposition Techniques.
2. Implement Cryptographic Algorithms.
3. Analyze and implement Authentication Techniques.
4. Understand and implement Key Exchange Techniques.
5. Demonstration of various security tools.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 52239 **0 0 3 1.5**

BIG DATA ANALYTICS LAB

(Program Specific Elective - 3)

Prerequisites:-Nil-

Course Objectives:

1. Understand Hadoop architecture and implementation of MapReduce Application.
2. Understand Big Data technologies and NOSQL.
3. Analyze and perform different operations on data using Pig Latin scripts
4. To explore tools and practices for working with big data.

List of Experiments:

Week 1:

Perform setting up and Installing Hadoop in its three operating modes:

a. Standalone b. Pseudo distributed c. Fully distributed

Week 2:

Implement the following file management tasks in Hadoop:

a. Adding files and directories b. Retrieving files c. Deleting files

Week 3:

Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

a. Find the number of occurrence of each word appearing in the input file(s)
b. Performing a MapReduce Job for word search count (look for specific keywords in a file)

Week 4:

Write a Map Reduce program that mines weather data.

Week 5:

Stop word elimination problem:

Input:

- A large textual file containing one sentence per line
- A small file containing a set of stop words (One stop word per line)

Output:

- A textual file containing the same sentences of the large input file without the words appearing in the small file.

Week 6:

Implement Matrix Multiplication with Hadoop Map Reduce

Week 7:

Install and Run MangoDb then use MangoDB to create, drop, insert, update and delete operations.

Week 8:

Install and Run Hbase then use Hbase to create, alter, and drop table.

Week 9:
Install and Run Hive then use Hive to create, alter, and drop tables.

Week 10:
Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data

Week 11:
Install spark and write a Program for Developing and Running a Spark Word Count Application.

Week 12:
Solve some real life big data problems.

Text Books:
1. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and presenting Data, Wiley publishers, 2015.
2. V.K. Jain, Big Data & Hadoop, Khanna Publishing House,2017
3. Tom White, Hadoop: The Definitive Guide, Third Edition, O'Reilley, 2012.

Reference Books:
1. Michael Minelli, Michelle Chambers and Ambiga Dhiraj, Big Data, Big Analytics, John Wiley & Sons, Inc.2013.
2. P.J Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012.
3. Eric Sammer, Hadoop Operations, O'Reilley, 2012.
4. Lars George, HBase: The Definitive Guide, O'Reilley, 2011.
5. Alan Gates, Programming Pig, O'Reilley, 2011.
6. Jason Rutherglen, Dean Wampler and Edward Capriolo, Programming Hive, O'Reilley, 2012.

Online Resources:
1. https://www.tutorialspoint.com/hadoop/index.htm
2. https://www.tutorialspoint.com/hive/index.htm
3. https://www.tutorialspoint.com/hbase/index.htm
4. https://www.tutorialspoint.com/apache_pig/index.htm

Course Outcomes:
After completion of the course, students will be able to
1. Demonstrate the different file management tasks using Hadoop.
2. Understand Map Reduce Paradigm and develop data applications.
3. Illustrate and apply different operations on relations using MangoDB and Hbase.
4. Illustrate and apply different operations on relations using Hive
5. Demonstrate different operations on data using Pig Latin Scripts.
6. Analysebig data quickly using spark framework.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523CT **3 0 0 3**

DIGITAL FORENSICS

(Program Specific Elective - 5)

Prerequisites:-Nil-

Course Objectives:

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.

UNIT 1: (~ 9 Lecture Hours)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

UNIT 2: (~ 8 Lecture Hours)

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 3: (~ 9 Lecture Hours)

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

UNIT 4: (~ 10 Lecture Hours)

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 5: (~ 12 Lecture Hours)

Mobile Forensics: Mobile forensics techniques, Mobile forensics tools.

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

Text Books:

1. John R. Vacca, Computer Forensics, Computer Crime Scene Investigation, 2nd Edition, Charles River Media, Inc.
2. John Sammons, The Basics of Digital Forensics, Elsevier.

Reference Books:

1. Tony Sammes and Brian Jenkinson, Forensic Computing, A Practitioner's Guide, Springer International Edition.
2. Dr. Darren R. Hayes, A Practical Guide to Computer Forensics Investigations Pearson Education Inc.
3. Christopher L.T. Brown, Computer Evidence: Collection and Presentation, 2nd Edition, Cengage Learning.
4. Robert M.Slade, Software Forensics Collecting Evidence from the Scene of a Digital Crime, 1st Edition, TMH.

Online Resources:

1. https://www.cs.nmt.edu/~df/Lecture Hours.html
2. https://booksite.elsevier.com/samplechapters/9780123742681/Chapter_1.pdf
3. https://www.cs.purdue.edu/homes/ninghui/courses/426_Fall10/handouts/CS426_forensics.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the need of digital forensics.
2. Understand application of computer forensics and digital detective and various processes, policies and procedures.
3. Explore E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Understand the requirements of Email and web forensics and network forensics.
5. Demonstrate usage of various forensic tools for a wide variety of investigations.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523CU **3 0 0 3**

HUMAN COMPUTER INTERACTION

(Program Specific Elective - 5)

Prerequisites: -Nil-

Course Objectives:

1. Learn the foundations of Human Computer Interaction.
2. Be familiar with the design technologies for individuals and persons with disabilities.
3. Be aware of mobile Human Computer interaction.
4. Learn the guidelines for user interface.

UNIT 1: (~ 9 Lecture Hours)
Human: I/O channels – Memory – Reasoning and problem solving.
The computer: Devices – Memory – processing and networks.
Interaction: Models – Frameworks – Ergonomics – styles – elements – interactivity.

UNIT 2: (~ 8 Lecture Hours)
Interactive Design basics: Process – scenarios – navigation – screen design and layout–Iteration and prototyping.
HCI in software process: Software Life Cycle –Usability engineering – Prototyping in practice – design rationale.

UNIT 3: (~ 11 Lecture Hours)
Design rules: Principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.
Cognitive models: Socio-Organizational issues and stakeholder requirements–Communication and collaboration models.

UNIT 4: (~ 9 Lecture Hours)
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile.
Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0.
Mobile Design: Elements of Mobile Design, Tools.

UNIT 5: (~ 8 Lecture Hours)
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.
Recent Trends: Speech Recognition and Translation, Multimodal System.

Text Books:

1. Alan Dix, Janet Finlay and Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, Mobile Design and Development, 1st Edition, O Reilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, Designing Web Interfaces, 1st Edition, O Reilly, 2009.

Reference Books:

1. Ben Shneiderman, Designing the user interface, 3rd Edition, Pearson Education Asia.
2. Wilbert O Galitz, The essential guide to user interface design, 2nd Edition, Wiley.
3. Sharp Rogers Preece, Interaction Design Beyond Human-Computer Interaction, 2nd Edition, Wiley Dreama Tech.

Online Resources:

1. http://www.tutorialspoint.com/sdlc/sdlc_overview.htm
2. https://www.w3schools.com/howto/howto_website.asp

Course Outcomes:

After completion of the course, students will be able to

1. Understanding the basic factors of human, computer and their interaction.
2. List the factors to design web interfaces.
3. Interpret the importance of HCI study and principles of User-Centred Design (UCD) approach.
4. Implementation of user interfaces by using design rules and cognitive models.
5. Evaluate usability of a user-interface design.
6. Develop mobile application interfaces with the knowledge of mobile ecosystem and its applications.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523CV **3 0 0 3**

CLUSTER AND GRID COMPUTING

(Program Specific Elective - 5)

Prerequisites: Computer Networks

Course Objectives:

1. An insight for achieving cost efficient high performance system.
2. Understand the design and architecture of grid and cluster computing.
3. Recent trends and case study for cluster computing.

UNIT 1: (~ 9 Lecture Hours)

Introduction: Cluster and Grid computing, Meta-computing, Web services and Grid Computing, e-Governance and the Grid Technologies and Architectures for Grid Computing: Issues in Data Grids, Functional requirements in Grid Computing, Standards for Grid Computing, Recent technology trends in Large Data Grids.

Web Services and the Service Oriented Architecture: Service Oriented Architecture, SOAP and WSDL, Creating Web Services, Server Side.

UNIT 2: (~ 9 Lecture Hours)

OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF, WSRF Specification, Globus Toolkit: History, Version, Applications, Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data Choreography and Coordination, GT4 Architecture, GT4 Containers.

The Grid and Databases: Requirements, Storage Request Broker, Integration of Databases with the Grid, Architecture of OGSA-DAI for offering Grid Database services.

UNIT 3: (~ 10 Lecture Hours)

Cluster Computing: Approaches to Parallel Computing, Definition and Architecture of a Cluster, Categories of clusters.

Cluster Middleware: Levels and Layers of Single System Image, Design objectives, Resource Management and Scheduling, Cluster programming Environment and Tools.

Networking, Protocols & I/O for clusters: Networking and Interconnection/Switching Devices, Design Issues, Design Architecture, HiPPI, ATM, Myrinet, Memory Channel.

UNIT 4: (~ 8 Lecture Hours)

Setting Up and Administering a Cluster: Setup of simple cluster, setting upnodes, clusters of clusters, System monitoring, Global Clocks Sync. Cluster.

Technology for High Availability: High availability clusters, high availability parallel computing, types of failures and errors, cluster architectures and configurations for high availability, Failure/Recovery clusters.

UNIT 5: (~ 10 Lecture Hours)

Process Scheduling: Job management System, Resource management system, policies of resource utilization, Scheduling policies.

Load Sharing and Load Balancing: Introduction, Strategies for load balancing, Modeling parameters.

Recent trends: Technologies and attributes in Cluster and Grid computing. Case study of various cluster architectures, load balancing and scheduling policies.

Text Book:

1. C.S.R. Prabhu, Grid and Cluster Computing, Kindle Edition, PHI, 2005.

Reference Books:

1. Joshy Joseph and Craig Fellenstein, Grid Computing, 1/e, Pearson Education, India.
2. D. Janakiram, Grid Computing, Tata Mc Graw Hill, 2005.

Online Resources:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643084.pdf
2. http://www.cs.kent.edu/~farrell/grid06/Lecture Hours/index.html
3. https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge of Grid Computing, Web Services, and Service-oriented architecture.
2. Illustrate the architecture for grid computing.
3. Get knowledge for setting up and administering a Cluster.
4. Understand the strategies for process scheduling and load balancing.
5. Know the recent trends in Cluster and Grid Computing.
6. Understand the case studies for various cluster architectures.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521HA/522HA **2 0 0 -**

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course - 1)

Prerequisites:-Nil-

Course Objectives:

1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To give the practice of writing a Research Paper.
4. To enable the students to evolve original research papers without subjected to plagiarism.

UNIT 1: (~7 Lecture Hours)

Academic Writing:

What is Research? - Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT 2: (~7 Lecture Hours)

Research Format:

Title – Abstract – Introduction – Discussion – Findings– Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT 3: (~6 Lecture Hours)

Research Methodology:

Methods (Qualitative – Quantitative) – Literature Review – Who did what – Criticizing, Paraphrasing & Plagiarism.

UNIT 4: (~6 Lecture Hours)

Process of Writing a research paper:

Choosing a topic - Thesis Statement – Outline – Organizing notes – Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing- Typing the final draft.

UNIT 5: (~6 Lecture Hours)

How to & where to get published:

Reputed Journals –National/International –ISSN No, No.of volumes, Scopes Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Reference Books:

1. MLA Hand book for writers of Research Papers, East West Press Pvt.
2. C.R. Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4th Edition.
3. LauriRozakis, Schaum's Quick Guide to Writing Great Research Papers, Tata McGraw Hills Pvt. Ltd, New Delhi.
4. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Course Outcomes:

After completion of the course, students will be able to

1. Understand the nuances of research writing.
2. Write a research paper with required writing skills and be confident to share their writing with others.
3. Publish a paper using the requisite standard in a journal.
4. Review the research papers and articles in a scientific manner.
5. Work on citations and ably place them in her research paper.
6. Avoid plagiarism with an ability to develop herown writing skills in presenting the research work.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521HB/522HB **2 0 0 -**

DISASTER MANAGEMENT

(Audit Course-1)

Prerequisites: Awareness about Various Planetary & Extra Planetary Hazards, theirImpacts & Mitigation measures

Course Objectives:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific 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.
5. Students will get the overview on the roles of government and non- government agencies in disaster management.
6. Describe the basic concepts of the emergency management cycle (mitigation, preparedness, response and recovery) and their application on various types of disasters.

UNIT 1: (~8 Lecture Hours)

Introduction and Repercussions of Disasters and Hazards: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. 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 2: (~5 Lecture Hours)

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with special reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT 3: (~5 Lecture Hours)

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness. Disaster Management Cycle.

UNIT 4: (~5 Lecture Hours)

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, People's Participation Risk Assessment, Strategies for Survival, Case Studies of Global, National and Local disasters, Techniques of Risk reduction for different disasters.

UNIT 5: (~5 Lecture Hours)

Disaster Risk Reduction &Mitigation: Meaning, Environment Security, Climate Change & Security risks, Climate Security Mechanism, Environmental Cooperation and Peace Building, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation - Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India. Role of NDMA in Disaster Mitigation in India.

Text Books:

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

Reference Books:

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
3. Satapathy S., Psychosocial care in Disaster management, A training of trainers manual (ToT), NIDM publication, 2009.
4. Guerisse P, Basic Principles of Disaster Medical Management, Act Anaesth. Belg; 56:395-40, 2005.
5. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.
6. UNEP.org- ECO - DRR

Online Resources:

1. https://www.mooc-list.com/tags/earthquake
2. https://freevideolectures.com/course/3581/earthquakes-in-your-backyard
3. https://summer.uci.edu/online/
4. http://www.open.edu/openlearn/free-courses/full-catalogue
5. https://www.edx.org
6. https://www.disasterready.org/courses
7. https://www.unep.org/explore-topics/disasters-conflicts/what-we-do/disaster-risk-reduction/ecosystem-based-disaster-risk

Course Outcomes:

After completion of the course, students will be able to

1. Acquire the knowledge of different disasters and measures to reduce the risk due to these disasters.
2. Plan institutional framework for disaster management at national as well as global levels.
3. Analyze, evaluate and manage the different public health aspects of disaster events at local and global levels, even when limited information is available.
4. Develop capacity to describe, the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
5. Acquire the knowledge on emergency/disaster management cycle for various types of disasters.
6. Develop a basic understanding of prevention, mitigation, preparedness, response and recovery on various types of disasters.

I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521HF/522HF **2 0 0 -**

PEDAGOGY STUDIES

(Audit Course- 1)

Prerequisites: -Nil-

Course Objectives:

1. To understand the programme design and policies of pedagogy studies.
2. To develop knowledge, abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. Analyze various theories of learning and their connection to teaching practice.
4. To familiarize the student with various research designs and research methods.
5. To create an awareness about the practices followed by DFID, other agencies and other researchers.
6. To identify critical evidence gaps to guide the development.

UNIT 1: (~8 Lecture Hours)

Introduction and Methodology:

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

UNIT 2: (~6 Lecture Hours)

Thematic overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT 3: (~6 Lecture Hours)

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

UNIT 4: (~6 Lecture Hours)

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

UNIT 5: (~6 Lecture Hours)

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

Reference Books:

1. Ackers J, Hardman F (2001) Classroom Interaction in Kenyan Primary Schools, Compare, 31 (2): 245 – 261.
2. Agarwal M (2004) Curricular Reform in Schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361 – 379.
3. AkyeampongK, (2003) Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER) Country Report 1.London: DFID
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving Teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count? International Journal Educational Development, 33 (3): 272- 282.
5. Alexander R J (2001) Culture and Pedagogy: International Comparisons in Primary Education.Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resources%20working%20paper%202.pdf.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview

Course Outcomes:

After completion of the course, students will be able to

1. The pedagogical practices followed by teachers in developing countries both informal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Importance of the role of teacher education, school curriculum and guidance materials for effective pedagogy.
5. Identify the criticalevidencegapsin teaching – learning and to develop strategic plan to fill the gaps.
6. Develop appropriate resources in alignment with the curriculum and its objectives.

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I Year M.Tech. CSE I-Semester **L T P C**
Course Code: 521HH/522HH **2 0 0 -**

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit Course - 1)

Prerequisites: -Nil-

Course Objectives:

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

UNIT 1: (~ 6 Lecture Hours)

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT 2: (~ 6 Lecture Hours)

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71, 73, 75 & 78 (do's) - Approach to day to day works and duties.

UNIT 3: (~ 7 Lecture Hours)

Introduction to Bhagavad Geetha for Personality Development – Shrimad Bhagawad 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 4: (~ 7 Lecture Hours)

Statements of basic knowledge - Shrimad Bhagawad Geeta: Chapter 2-Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT 5: (~ 6 Lecture Hours)

Role of Bahgavad Geeta in the present scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Reference Books:

1. Srimad Bhagavad Gita by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's ThriSatakam (Niti – Sringar- Vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Online Resources:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

Course Outcomes*:*

After completion of the course, students will be able to

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Develop versatile personality.
4. Harmonize peace and mental well-being to handle day-to-day works more productively.
5. Understand oneself for holistic development.
6. Explore one's own potential to enhance their productive work.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 521HC/522HC **2 0 0 -**

SANSKRIT FOR TECHNICAL KNOWLEDGE

(Audit Course - 2)

Prerequisites: -Nil-

Course Objectives:

1. To get a working knowledge in Illustrious SANSKRIT, the scientific language in the world.
2. To improve brain functioning.
3. To enhance the memory power to develop logic in Mathematics, Science and other subjects.
4. To explore the huge treasure of knowledge that is hidden in the ancient literature.

UNIT 1: (~6 Lecture Hours)

Alphabets in SANSKRIT

Varnamala – Vowels (Swaraaha) and consonants (Vyanjanaani) – samyuktavarnaaha (compound letters) – Varna vishleshanam (Disjoining of letters) – Varna samshleshanam (Joining of letters) - Practise of simple words – Three genders – Pumlingam (Masculine Gender) – Streelingam (Feminine Gender) – Napumsaka lingam (Neutral Gender) – The forms of Nouns – Singular & Plural

UNIT 2: (~6 Lecture Hours)

Pronouns & Demonstrative pronouns (Sarvanaamashabdaaha) Eshaha, Yeshaa&Yetat –Question words – Five Ws& one H (Kim, kadaa, kutra, Kaha, Kimartham&Katham) Different forms of verbs – Tenses – Present – Past & Future Tenses.

UNIT 3: (~6 Lecture Hours)

Propositions (Vibhaktis) – Prathama – Dwitiya – Truteeya – Chaturthee – Panchami – Shashtee – Saptami – Sambodhana Prathama The Three Purushas – Prathama (RamahaRaamouRaamaaha) – Madhyama (twamYuvaamYooyam) – Uttama (AhamAawaamVayam)

UNIT 4: (~6 Lecture Hours)

Order (Subject – Verb – Object) karta – Kriya - karma

Introduction of Roots – Ancient literature on Science & Technology in SANSKRIT language - Scope of SANSKRIT in India – Technical information about SANSKRIT Literature. - Technical concepts of Engineering.

UNIT 5: (~6 Lecture Hours)

Technical concepts of Engineering – Electrical, Mechanical, Architecture and Mathematics - Role of SANSKRIT in the field of Science & Technology. Scope of SANSKRIT as a powerful & alternative tool in the field of Computer Science.

Suggested Reading:

1. Abhyaas Pustakam and Dr. Vishwas, Samskrutha Bharati Publications, New Delhi.
2. Vempati Kutumba Shastri and Prathama Deeksha, Teach Yourself SANSKRIT, Rashtriya Sanskrit Sansthan, New Delhi Publications.
3. Suresh Soni, India's glorious Scientific Tradition, Ocean Books Pvt. Ltd., New Delhi.

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge in basic SANSKRIT language.
2. Understand the ancient SANSKRIT literature about Science & Technology.
3. Develop logical and analytical skills.
4. Relate the relevance of Sanskrit to Science and Technology
5. Appreciate the conceptual understanding of Sanskrit to develop one's own competencies to understand, analyze and apply to sciences.
6. Identifying the similarities and differences to develop linguistic competency in learning a new language.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 521HD/522HD **2 0 0 -**

VALUE EDUCATION

(Audit Course - 2)

Prerequisites: -Nil-

Course Objectives:

1. Understand value of Education and self-development.
2. Imbibe good values in students
3. Know the importance of character

UNIT 1: (~7 Lecture Hours)

Values and self – development – Social values and Individual attitudes. Work ethics, Indian vision of humanism - Moral and non – moral Valuation - Standards and principles - Value judgements - Importance of cultivation of values.

UNIT 2: (~6 Lecture Hours)

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

UNIT 3: (~6 Lecture Hours)

Personality and Behaviour Development – Soul and Scientific attitude. Positive thinking. Integrity and Discipline - Punctuality, Love and Kindness - Avoid Fault Thinking - Free from anger, Dignity of labour

UNIT 4: (~6 Lecture Hours)

Universal brotherhood and religious tolerance - True friendship - Happiness Vs suffering, love for truth - Aware of self - destructive habits - Association and Cooperation - Doing best for saving nature.

UNIT 5: (~6 Lecture Hours)

Character and Competence – Holy books Vs Blind faith - Self-management and Good Health - Science of Reincarnation - Equality, Nonviolence, Humility, Role of Women - All religions and same message - Mind your Mind, Self- control - Honesty, Studying effectively.

Reference Books:

1. Chakroborty, SK. Values and Ethics for Organizations – Theory and Practise, - Oxford University Press, NewDelhi.

Online Resources:

1. http://nptel.ac.in/courses/109104068/36
2. http://nptel.ac.in/courses/109104068/37

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge on self-development.
2. Learn the importance of Human Values.
3. Develop overall personality.
4. Understand the importance of value education to build tolerance and harmony at different layers.
5. Identify the ways for self-development.
6. Identify the basic values and principles to guide one's own life.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 521HE/522HE **2 0 0 -**

CONSTITUTION OF INDIA

(Audit Course - 2)

Prerequisites:-Nil-

Course Objectives:

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

UNIT 1: (~ 8 Lecture Hours)

History of making of the Indian Constitution & Philosophy of the Indian Constitution History of making of the Indian Constitution: History, Drafting Committee (Composition & Working) **Philosophy of the Indian Constitution**: Preamble, Salient Features.

UNIT 2: (~ 6 Lecture Hours)

Contours of Constitutional Rights and Duties:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT 3: (~ 6 Lecture Hours)

Organs of Governance:

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

UNIT 4: (~ 6 Lecture Hours)

Local Administration:

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

UNIT 5: (~ 6 Lecture Hours)

Election Commission:

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

Reference Books:

1. The Constitution of India, Government Publication, 1950 (Bare Act).
2. Dr.S.N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.

Online Resources:

1. https://nptel.ac.in/courses/129106003 [Constitutional Studies by Prof. Sudhir Krishna Swami, IIT Madras]
2. https://onlinecourses.swayam2.ac.in/cec20_hs38/preview [Indian Government and Politics by Dr.Aijaz Ashraf Wani, University of Kashmir,Srinagar]

Course Outcomes:

After completion of the course, students will be able to

1. Tell about function of Indian constitution with clarity and understanding.
2. Identify the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Mark the knowledge of union government & their powers and function.
4. Define the state and central policies, fundamental duties.
5. Explain the powers and functions of Municipalities, Panchayats and Co-operative Societies.
6. Discuss the Electoral Process, special provisions.

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I Year M.Tech. CSE II-Semester **L T P C**
Course Code: 521HG/522HG **2 0 0 -**

STRESS MANAGEMENT BY YOGA

(Audit Course - 2)

Prerequisites: -Nil-

Course Objectives:

1. Creating awareness about different types of Stress and role of Yoga in the management of Stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by Yoga practice.

UNIT 1: (~4 Lecture Hours)

- Meaning and definition of Yoga
- Historical perspective of Yoga
- Principles of Astanga Yoga by Patanjali.

UNIT 2: (~4 Lecture Hours)

- Meaning and definition of Stress.
- Types of Stress-Eustress and Distress.
- Anticipatory Anxiety and Intense Anxiety and depression.
- Meaning of Management- Stress Management.

UNIT 3: (~8 Lecture Hours)

- Concept of Stress according to Yoga
- Stress assessment methods
- Role of Asana, Pranayama and Meditation in the management of stress.

UNIT 4: (~8 Lecture Hours)

Asanas:: (5 Asanas in ach posture)

- Warm up
- Standing Asanas
- Sitting Asanas
- Prone Asanas
- Supine asanas
- Surya Namaskar

UNIT 5: (~8 Lecture Hours)

Pranayama:

- Anulom and Vilom Pranayama
- Nadishudhi Pranayama
- Kapalabhati Pranayama
- Bhramari Pranayama
- Nadanusandhana Pranayama.

Meditation techniques:

- Om Meditation
- Cyclic meditation: Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Reading:

1. Andrews and Linda Washer, Stress control for peace of mind, London: Greenwich Editions, 2005.
2. Author's Guide -Yoga- The science of Holistic Living, Chennai: The Vivekananda Kendra Prakashan trust.
3. Iyengar BKS, The art of Yoga, New Delhi: Harper Collins Publishers, 2003.
4. Lalvani and Vimla, Yoga for Stress, London: Hamlyn, 1998.
5. Maguire andImelda, Yoga for a healthy body, London: Greenwich Editions, 2005.
6. Nagendra H.R. and Nagaratna.R, Yoga prespective in stress management, Bangalore: Swami Vivekananda Yoga prakashan, 2004.
7. Nagendra H.R. and Nagaratna.R, Yoga practices for Anxiety and Depression, Bangalore: Swami Sukhabhogananda Yoga prakashan, 2004.
8. Sukhabhogananda Swami, Stress management, Bangalore: Prakashan trust, 2002.
9. Udupa, Stress management by Yoga, New Delhi: MotilalBandaridas Publishers pvt. Ltd., 1998.
10. Ravi Shankar N.S., Yoga for Health, New Delhi: PustakMahal, 2001.

Reference Books:

1. Chakroborty, SK, Values and Ethics for Organizations – Theory and Practice, - Oxford University Press, New Delhi.

Course Outcomes:

After completion of the course, students will be able to

1. Enhancement of Physical strength and flexibility.
2. Learn to relax and focus.
3. Relieves physical and mental tension
4. Improved work performance/efficiency.
5. Integrate Yoga into one's lifestyle.
6. Learn to practice the basic concepts of yoga to manage stress.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GA **3 0 0 3**

BUSINESS ANALYTICS

(Open Elective)

Prerequisites: -Nil-

Course Objectives:

1. To understand the role of business analytics within an organization.
2. To gain an understanding in usage of business analytics in formulating and solving problems using analytical and management tools in managerial decision making.
3. To Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization and across various sectors.

UNIT 1: (~08 Lecture Hours)

Introduction to Business Analytics

Introduction to Analytics - Importance of Analytics in Problem analytics - Business Analytics - Importance - Difference between Business Analytics and Business Intelligence - Evolution of Business Analytics - Types of Business Analytics - Characteristics - Goals - Domains of Business Analytics - Framework of Business Analytics - Analytics Ecosystem - Process - advantages - steps of Decision modeling for Business Analytics.

UNIT 2: (~09 Lecture Hours)

Organization Structure and Data for Business Analytics

Organization Structure of Business Analytics - Functional organization - Matrix - centralized structure with Business Analytics - Factors determining in choosing appropriate structure - Reasons for organizational failure for Business Analytics Initiatives - Team Management - Reasons for Team failure

Data - Characteristic of Readiness of data Dimensions - Data taxonomy - Data mining - Process - Implications of Data outlines- Steps in data driven decision making - Importance of sampling - Data visualization - Types of Data Storytelling - Data Journalism - Data warehousing.

UNIT 3: (~10 Lecture Hours)

Descriptive Analytics

Introduction to Descriptive Analytics, Measure of Central tendency-Mean, Median, Mode Measure of Variation-Variance, Standard deviation, Mean Deviation, Interquartile Deviation Measure of Shape-Kurtosis, Skewness, Measure of Association-Covariance, Correlation

Random Variables: Discrete probability Distribution and Continuous Probability Distribution (Mean, Median, Mode)

UNIT 4: (~10 Lecture Hours)

Predictive and Prescriptive Analytics

Predictive Analytics- Regression- Simple linear regression, Multiple linear regression-Test of significance of regression coefficients Using ANOVA (one way and twoway classification), Coefficient of Determination. Forecasting -Time Series Analysis- Trend Analysis, Moving Average Method, ARMA Model with error Analysis.

Prescriptive Analytics: Linear Programing Problem- Graphical Method, Simplex Method

UNIT 5: (~08 Lecture Hours)

Decision Analysis

Problem Formulation, Decision analysis without probabilities, Decision analysis with probabilities, Decision Analysis with sample information, Computing Branch Probabilities with Bayes Theorem, Utility Theory.

Text Books:

1. Ramesh Sharada, Dursun Delen, Efraim Turban and David King, Business Intelligence, Analytics, and Data Science - A Managerial Perspective, Pearson, 4th Edition.
2. U Dinesh Kumar, Business Analytics - The Science of Data-Driven Decision Making, Wiley, 2nd Edition.

Reference Books:

1. Gert H.N. Laursen and Jesper Thorlund, Business Analytics for Managers - Taking Business Intelligence Beyond Reporting, Wiley, 2nd Edition.
2. Camm, Cochran, Fry, Ohlmann, anderson, Sweeney and Williams: Essentials of Business Analytics, Cengage Publishers.

Online Resources:

1. NPTEL: Business Analytics for Management Decision -http://nptel.ac.in/courses/110105089/

Course Outcomes:

After completion of the course, students will be able to

1. Understand and apply business analytics in real time world.
2. Comprehend the structure of an organization for business analytics implementation.
3. Identify the befitting descriptive tool required for the business problem.
4. Apply suitable predicative method that supports business decision making.
5. Identify appropriate prescriptive modeling techniques for decision making.
6. Translate data into clear, actionable insights in the decision-making process.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GB **3 0 0 3**

INDUSTRIAL SAFETY

(Open Elective)

Prerequisites: Industrial Management

Course Objectives:

1. Concepts of industrial safety and provide useful knowledge for work place safety.
2. Understand Industrial Safety Programs, Fire explosions and its Preventive methods.
3. Helps in identification, evaluation and control of the hazards.
4. Mitigate harm to people, property and the environment.
5. Quality maintenance process, Duties & Responsibilities of Safety officer's.
6. Overhauling of Mechanical & Electrical machinery components, difference between Periodic & Preventive Maintenance.

UNIT 1: (~10 Lecture Hours)

Industrial Safety: Importance and objectives of safety, safety programs – components and realisation. Evolution of modern safety concept, safety policy, safety organisation. Implementation of safety procedures.

UNIT 2: (~10 Lecture Hours)

Accidents: causes, types, results and control, mechanical and electrical hazards types, causes and preventive steps, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water, lights, cleanliness fire guarding etc. safety colour code, fire prevention and firefightingequipments and methods.

UNIT 3: (~10 Lecture Hours)

Fundamentals of maintenance engineering: Definition of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, types of maintenance, maintenance cost and its relations with replacement economy, service life of equipment.

UNIT 4: (~8 Lecture Hours)

Quality and safety in maintenance: needs for quality maintenance process, maintenance work quality, use of quality control, post maintenance testing, reasons for safety problems in maintenance, guidelines to safety in maintenance work, safety officers' role in maintenance work, Protection of maintenance workers.

UNIT 5: (~10 Lecture Hours)

Types of maintenance: corrective, breakdown, predictive, replacement, preventive and proactive maintenance.

Periodic and preventive maintenance in details: Periodic maintenance: inspection- concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motors, common troubles and remedies of electric motor, repair complexities and its use

Preventive maintenance: definition, needs, steps and advantages.

Text Books:

1. Krishnan N.N., Safety management in industries, Jaico publishing house, Bombay, 1997.
2. H.P. Garg S., Maintenance Engineering, S. Chand and company.

Reference Books:

1. Handley,W. Industrial safety Hand book, 2nd Edition, McGraw-Hill Book Company, 1969
2. Higgins & Morrow, Maintenance Engineering Handbook, Da Information Services.
3. Mc Cornick, E.J., Human Factors in Engineering and design, Tata McGraw-Hill, 1982

Online Resources:

1. https://www.spplimited.co.in/industrial-safety-certificate-course-trainingin-chennai/
2. https://onlinecourses.nptel.ac.in/noc18_mg42/preview

Course Outcomes:

After completion of the course, students will be able to

1. Know the need for safety in industries.
2. Know about factory acts and industrial safety regulations.
3. Analyse causes and types of different hazards on their preventions.
4. Assess quality maintenance processes and maintenance work quality.
5. Assess safety practices and programs.
6. Know about periodic and preventive maintenance activities in industries.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GC **3 0 0 3**

OPERATIONS RESEARCH

(Open Elective)

Prerequisites: -Nil-

Course Objectives:

1. Study the linear programming and non-linear programming techniques used for business and engineering applications.
2. Understand the importance of dynamic programming concept in operations research
3. Know about the inventory, Game theory and waiting line model applications in real world.

UNIT 1: (~10Lecture Hours)

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem-Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M methods, Special cases in LP-Degeneracy, unbounded, infeasibility & alternative optima.

UNIT 2: (~10Lecture Hours)

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible Solutions-Northwest corner rule, least cost method and Vogel's approximation method. Optimality test by MODI method & stepping stone method.

Assignment problem: Formulation. Hungarian method for optimal solution. Solving unbalanced Assignment problem.

UNIT 3: (~10Lecture Hours)

Dynamic programming. Characteristics of dynamic programming. Dynamic programming approach for Coach/ Shortest Path and cargo loading problems.

Inventory models. Inventory costs. Models with deterministic demand-model (a) demand rate uniform and production rate infinite, model (b) demand rate uniform and production rate finite.

UNIT 4: (~10Lecture Hours)

Games Theory. Competitive games rectangular game saddle point, minimax (maximin) method of optimal strategies, and value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point-mixed strategy for 2*2 games.

Waiting lines: Single channel –poison arrivals and exponential service times with infinite population and finite population models. Multi-channel- poisson arrivals and exponential service times with infinite population.

UNIT 5: (~ 8 Lecture Hours)

Non-linear Programming: Introduction to non-linear programming (NLP), Convex and concave functions, NLP with one variable, Line search algorithms, Multivariable unconstrained problems, constrained problems, Lagrange Multiplier, The Karush-Kuhn-Tucker (KKT) conditions, the method of steepest ascent, convex combination method, penalty function, Quadratic programming

Text Books:

1. J. K. Sharma, Operations Research, theory and applications, 5th Edition, Macmillan India Ltd,2013
2. S. S. Rao, Engineering Optimisation – Theory and Practice, 4th Edition, John Wiley & Sons Inc., 2009.

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008.
2. F.H. Hillier and G.J. Lieberman, Introduction to Operations Research, Tata-McGraw-Hill, 2010.
3. S.D. Sharma, Operations Research, Kedarnnath, Ramnath & Co., Meerut, 2009.
4. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi, 2004.

Course Outcomes:

After completion of the course, students will be able to

1. Apply linear programming models to several Engineering Applications.
2. Solve selected models in Dynamic Programming practical applications.
3. Apply simple mathematical models in Inventory into the real Engineering Applications.
4. Solve Game theory problems related to business applications,
5. To minimize waiting time of the customer and optimization of number of servers.
6. Able to apply the concept of non-linear programming models to various engineering applications.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GD **3 0 0 3**

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

Prerequisites:-Nil-

Course Objectives:

1. Give inputs in handling the cost associated with engineering projects.
2. Acquaint the practical aspects of cost management.
3. Orient the quantitative techniques applicable to cost management.

UNIT 1: (~ 8 Lecture Hours)

Introduction to Project Management

Project- Need of Project Management- Objectives -Scope- Importance of Project Management -Principles of Project Management- Types of Projects-Roles and Responsibilities of Project Team.

UNIT 2: (~ 9 Lecture Hours)

Project Planning and Implementation

Project Management Life Cycle-Process-Project Selection – Feasibility study: Types of feasibility - Steps in feasibility study- Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations – Basic Scheduling Concepts - Resource Levelling – Resource Allocation-Execution.

UNIT 3: (~ 8 Lecture Hours)

Cost Management for Projects

Introduction and importance of Cost Management for Projects- Objectives of Costing System -Various cost concepts- Cost Classification on the basis of behaviour (as variable, fixed and semi variable)-Traceability (as direct and indirect)- Functions (as production cost, administration cost, selling cost and distribution cost).

UNIT 4: (~10 Lecture Hours)

Budgetary Control

Introduction to Budget- Concepts, Advantages- Types of Functional budgets: Fixed and Flexible budget, Performance budget, Cash Budget and Production Budget (Simple Problems on Functional based budget). Introduction to Zero based budgeting.

UNIT 5: (~10 Lecture Hours)

Project-Cost Management

Project Cost Estimation- Project Financing- Project Planning and Scheduling-Project Cost Control-Quantitative Techniques for Project Cost Management-Linear Programming-Network Analysis-PERT/CPM-Project Cost Analysis-Transportation Model-Assignment Model (Simple Problems)- Simulation-Learning Curve Theory-Project Methodologies-Types-Project Integrated Management (PIM).

Text Books:

1. K.Nagarajan, Project Management, New Age International Publishers.
2. L.S.Srinath, PERT and CPM Principles and Applications.
3. Charles T. Horngren and George Foster, Cost Accounting: A Managerial Emphasis, PHI, 1st Edition.

Reference Books:

1. Arun Kanda, Project Management A Life Cycle Approach, Prentice Hall of India, 2011.
2. R.B.Khanna, Project Management, Prentice Hall of India, 2011.
3. R.Panneerselvam and P.Senthilkumar, Project Management, Prentice Hall of India, 2009.
4. Blocher, Chen, Cokins, and Lin, Cost Management: A Strategic Emphasis.
5. John K. Shank and Vijay Govindarajan, Strategic Cost Management.

Online Resources:

1. http://nptel.ac.in/courses/110101004/24

Course Outcomes:

After completion of the course, students will be able to

1. Perceive the cost associated in managing engineering projects
2. Develop Project Planning proposal considering time and cost
3. Furnish effective cost management practices for better handling of engineering projects
4. Prepare budgets for engineering projects.
5. Propose the Quantitative Techniques for Project Cost Management.
6. Orient the cost management decision-making using quantitative methodology in minimizing the cost associated with the projects.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GE **3 0 0 3**

COMPOSITE MATERIALS

(Open Elective)

Prerequisites: -Nil-

Course Objectives:

1. Learn to demonstrate a critical understanding of composite materials of their nature and application.
2. Critically evaluate the types of reinforcements and their advantages in application.
3. Develop an understanding of different types of metal matrix composites and their preparation.
4. Develop an understanding of different types of ceramic matrix composites and their preparation.
5. Develop an understanding of different types of polymer matrix composites and their preparation.
6. Critically evaluate strength of the composite materials through laminar study.

UNIT 1: (~ 9 Lecture Hours)

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT 2: (~ 9 Lecture Hours)

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behaviour of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT 3: (~ 9 Lecture Hours)

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. **Manufacturing of Carbon – Carbon composites:** Knitting, Braiding, Weaving. Properties and applications.

UNIT 4: (~ 8 Lecture Hours)

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT 5: (~ 9 Lecture Hours)

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro-thermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. R.W.Cahn – VCH, Material Science and Technology – Vol 13 – Composites, West Germany.
2. R. Balasubramaniam, Callister's Materials Science and Engineering, An introduction, John Wiley & Sons, NY, Indian Edition, 2007.

Reference Books:

1. Ed-Lubin, Hand Book of Composite Materials.
2. K.K.Chawla, Composite Materials.
3. Deborah D.L. Chung, Composite Materials Science and Applications.
4. Danial Gay, Suong V. Hoa, and Stephen W, Composite Materials Design and Applications.

Online Resources:

1. http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Composite%20Materials/pdf/ Lecture_Notes/LNm1.pdf
2. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf
3. http://home.iitk.ac.in/~mohite/Composite_introduction.pdf
4. https://onlinecourses.nptel.ac.in/noc18_me03/preview
5. https://www.online.colostate.edu/courses/MECH/MECH530.dot

Course Outcomes:

After completion of the course, students will be able to

1. Differentiate composite materials and their applications.
2. Analyse, evaluate and manage the different the types of reinforcements.
3. Develop different types of metal matrix composites and prepare the same for their specific needs as engineers.
4. Develop different types of ceramic matrix composites and prepare the same for their specific needs as engineers.
5. Develop different types of polymer matrix composites and prepare the same for their specific needs as engineers.
6. Critically enhance strength of the composite materials through laminar usage.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GF **3 0 0 3**

ENERGY FROM WASTE

(Open Elective)

Prerequisites: -Nil-

Course Objectives:

1. To classify various waste resources.
2. To identify various methods of waste disposal.
3. To study various energy generation methods from waste.
4. To analyze various processes of recycling of waste and environmental benefits.

UNIT 1: (~8 Lecture Hours)

Classification of waste – Agro based, Domestic, Bio-Medical, Forest residue, Industrial waste, recycling of waste, Segregation of waste, waste treatment, Environmental impacts. Land fill method fordisposal of waste, Landfill classification.

Guidelines for Minimization of Wastage in Society (Individual houses, Apartments, Industries etc.)-Reduce, Reuse & Recycle. Minimization of all types of wastage through Orientation programs, Awareness camps, workshops, seminar etc.

Group Discussion Activity (~2 Lecture Hours)

UNIT 2: (~9 Lecture Hours)

Biomass: Pyrolysis – Byproducts of Pyrolysis– Manufacture of pyrolytic oils and gases, applications. Biomass Gasification: Gasifiers – Fixedbed system –Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation Concepts of Gasifier Arrangements, Burner and Engine arrangements for electric power generation.

UNIT 3:(~8 Lecture Hours)

Biomass Combustion: Biomass stoves – Improved challahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT 4:(~8 Lecture Hours)

Biogas: Properties of biogas (Calorific value and composition), Biomass resources and their classification - Biomass conversion processes.

Types of biogas Plants, Applications, Alcohol production from biomass- Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

UNIT 5: (~7 Lecture Hours)

E-waste: e-waste in the global context- Environmental concerns and health hazards Recycling e-waste, Global trade in hazardous waste, e-waste legislation, Government regulations on e-waste management.

Note:A classroom activity such as Group Discussion involving allstudents to be conducted on the topics given in the second half of first unit.

Text Books:

1. Desai and Ashok V., Non-Conventional Energy, Wiley Eastern Ltd.,1990.
2. Challal, D.S., Food, Feed and Fuel from Biomass, IBH Publishing Co.Pvt.Ltd.,1991.
3. Nicholas P.Cheremisinoff, Hand book of Solid Waste Management and Waste Minimization Technologies, An Imprint of Elsevier, New Delhi, 2003.
4. T.V. Ramachandra, Management of Municipal Solid Waste, The Energy and Resources Institute, TERI, 2009.

Reference Books:

1. C.Y.WereKo-Brobby and E.B.Hagan, Biomass Conversion and Technology, John Wiley & Sons, 1996.
2. M.Dutta,B.P.Parida,B.K.Guha and T.R.Surkrishnan, Industrial Solid Waste Management and Land filling practice,Narosa Publishing House, New Delhi, 1999.
3. Khandelwal, K.C. and Mahdi S.S., Biogas Technology-A Practical Hand Book Vol.I& II, Tata Mc Graw Hill Publishing Co.Ltd., 1983.

Online Resources:

1. https://nptel.ac.in/courses/103107125

Course Outcomes:

After completion of the course, students will be able to

1. Understand the methods of recycling of waste.
2. Compare the methods of waste disposal.
3. Identify different sources of energy from waste.
4. Analyze methods for management of waste.
5. Understand the global trade in hazardous waste.
6. Understand and adapt Waste minimization techniques as a societal responsibility.

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II Year M.Tech. CSE I-Semester **L T P C**
Course Code: 523GG **3 0 0 3**

POWER FROM RENEWABLE ENERGY SOURCES

(Open Elective)

Prerequisite: -Nil-

Course Objectives:

1. To introduce various types of renewable energy technologies.
2. To understand the technologies of energy conversion from the resources and their quantitative analysis

UNIT 1: (~10 Lecture Hours)

Fundamentals of Solar Energy-Solar spectrum- Solar Radiation on Earth's surface- Solar radiation geometry- Solar radiation measurements- Solar radiation data- Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion- Flat plate collectors- concentrated collectors- construction and thermal analysis- Solar applications- Solar ponds- Heliostat systems-water heater-air heater-solar still.

UNIT 2: (~8 Lecture Hours)

Solar-Electric Power generation- Photovoltaic cells- Equivalent circuit- V-I Characteristics- Photovoltaic modules – constructional details- design considerations- Tracking- Maximum power point tracking - Solar Thermo electric conversion.

UNIT 3: (~8 Lecture Hours)

Wind Energy- Fundamentals of wind energy-power available in wind- Betz Limit Aerodynamics of wind turbine- Wind turbines- Horizontal and vertical axis turbines

–their configurations- Wind Energy conversion systems

UNIT 4: (~9 Lecture Hours)

Energy from Bio Mass- Various fuels- Sources-Conversion technologies-Wet Processes – Dry Processes- Bio Gas generation – Aerobic and anaerobic digestion - Factors affecting generation of bio gas - Classification of bio gas plants-Different Indian digesters- Digester design considerations - Gasification process - Gasifiers – Applications. Geothermal Energy - sources- Hydrothermal convective - Geo- pressure resources - Petro-thermal systems (HDR) - Magma Resources-Prime Movers.

UNIT 5: (~9 Lecture Hours)

Ocean Thermal Energy Conversion Systems- Principle of operation - Open and closed cycles, Energy from Tides - Principle of Tidal Power - Components of tidal Power plants - Operation Methods - Estimation of Energy in Single and double basin systems - Energy and Power from Waves Wave energy conversion devices - Fuel Cells - Design and Principle of operation - Types of Fuel Cells - Types of Electrodes – Applications - Basics of Batteries - Constructional details of Lead acid batteries - Ni-Cd Batteries.

Text Books:

1. John Twidell & Wier, Renewable Energy Resources, CRC Press, 2009.
2. G. D. Rai, Non-Conventional Energy sources, Khanna publishers, 2004.

Reference Books:

1. D. P.Kothari, Singal, Rakesh and Ranjan, "Renewable Energy sources and Emerging Technologies", PHI, 2009.
2. F. C. Treble, "Generating Electricity from Sun", Pergamon Press, 1st Edition 1991
3. C. S. Solanki, "Solar Photovoltaics - Fundamentals- Principles and Applications", PHI, 2009
4. S. P. Sukhatme, "Solar Energy Principles and Application", TMH, 2009.

Online Resource:

1. https://nptel.ac.in/courses/103103206

Course Outcomes:

After completion of the course, students will be able to

1. Analyse solar thermal and photo voltaic systems and related technologies for energy conversion.
2. Understand Wind energy conversion and devices available for it.
3. Understand Biomass conversion technologies, Geothermal resources and energy conversion principles and technologies
4. Realize Power from oceans (thermal,wave,tidal) and conversion devices
5. Understand fundamentals of fuel cells and commercial batteries.
6. Suggest suitable methods of power generation for a particular region/organization based on the availability of resources.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1:	The student should be able to apply their knowledge in Mathematics, Science, Engineering as well as Computer Science along with programming skills in their Engineering education and career advancement.
PEO 2:	They are expected to communicate well and get ready for understanding the importance of social, business, technical and ethical aspects with which a process or product is designed.
PEO 3:	They should be able to excel in multidisciplinary teams, develop leadership roles and inculcate problem solving capability, design skills and other diverse career paths.
PEO 4:	They should be able to develop an interest in knowledge enhancement with the evolving technologies.

PROGRAM OUTCOMES (POs) – M.Tech. (CSE)

PO 1	An ability to independently carry out research/investigation and development work to solve practical problems
PO 2	Ability to write and present a substantial technical report/document.
PO 3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Ability to understand advanced computing technologies and develop coding skills in domain specific areas.
PO 5	Ability to engage in lifelong learning and inculcate professional ethics.

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (For Women)
(AUTONOMOUS)

INSTITUTE VISION

To become a center of quality education in Engineering and Technology for women empowerment.

INSTITUTE MISSION

- To fulfill the academic aspirations of women engineers for enhancing their intellectual capabilities and technical competency.
- To Leverage Leading – Edge Technologies and cultivate exemplary work culture.
- To facilitate success in their desired career in the field of engineering to build a progressive nation.

INSTITUTE QUALITY POLICY

G. Narayanamma Institute of Technology and Science (For Women), Hyderabad is committed in imparting Quality Education and Training for women empowerment in the field of "Engineering and Technology" and to satisfy applicable requirements through continual improvement of the Quality Management System by facilitating and supporting the staff and students to work as a team in upgrading their knowledge and skill in tune with the industrial and technological developments through a set of Quality objectives.