REGULATIONS, COURSE STRUCTURE AND SYLLABUS

For

B.Tech.

Computer Science & Engineering

With effective from the Academic Year 2021-2022

B.Tech. Regulations

1.1 Short title and Commencement

The regulations listed under this head are common for all degree level under graduate programs (B.Tech.) offered by the college with effect from the academic year 2021-22 and they are called as "SITE21" regulations.

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

1.2. Definitions

a. "Commission" means University Grants Commission(UGC)
b. "Council" means All India Council for Technical Education(AICTE)
c. "University" Means Jawaharlal Nehru Technological University Kakinada(JNTUK)
d. "College" means Sasi Institute of Technology & Engineering, Tadepalligudem.
e. "Program" Means any combination of courses and /or requirements leading to award of a degree
f. "Course" Means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.
g. For example, (ELECTRONC DEVICES) is a course offered at third semester of B.Tech (ECT) and its code is (21ETETT3030)
h. "Degree" means an academic degree conferred by the university upon those who complete the undergraduate curriculum
i. "Regular Student" means student enrolled into the four year programme in the firstyear
j. "Lateral entry Students" Means student enrolled into the four year programme in the secondyear

1.3. Academic Programs

1.3.1. Nomenclature of Programs

The nomenclature and its abbreviation given below shall continue to be used for the degree programs under the University, as required by the Council and Commission. The name of specialization shall be indicated in brackets after the abbreviation. For e.g. UG engineering degree in Mechanical Engineering program is abbreviated as B.Tech. (ME). Bachelor of Technology (B.Tech.) degree program offered in:

1. Artificial Intelligence & Machine Learning(AI & ML)
2. Civil Engineering(CE)
3. Computer Science and Engineering(CSE)
4. Computer Science and Technology(CST)
5. Electronics and Communication Engineering(ECE)
6. Electronics and Communication Technology(ECT)
7. Electrical and Electronics Engineering(EEE)
8. Information Technology(IT)
9. Mechanical Engineering(ME)

- Curriculum framework is important in setting the right direction for a Degree program as it takes into account the type and quantum of knowledge necessary to be acquired by a student to qualify for a award in his/her chosen branch or specialization.
- Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to be studied and the total number of credits to be earned by a student to fulfill the requirements for conferment of degree.
- Each theory course shall consist of five units.

1.3.2. Curriculum Structure

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

1.3.3. Induction Program

The Induction Program for two weeks is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students and building of character. Induction program covers

- Physical activity
- Creative arts
- Universal human values
- Literary and Proficiency modules
- Lectures by Eminent peoples

1.4Admission Criteria

The eligibility criteria for admission into UG engineering programs are as per the norms approved by government of Andhra Pradesh from time to time. The sanctioned seats in each program in the college are classified into CATEGORY-A and CATEGORY-B at first year level and Lateral Entry at second year level.

- **CATEGORY – A Seats:** These seats will be filled as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – B Seats:** These seats will be filled by the College as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – Lateral Entry Seats** :Lateralentry candidates shall be admitted into the Third semester directly as per the norms approved by government of Andhra Pradesh. The percentages of Category-A, Category-B and Lateral Entry Seats are decided time to time by the Government of Andhra Pradesh.

2. Award of B. Tech. Degree

a) A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

i. A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall forfeit their seat in B.Tech course and their admission stands cancelled.
ii. The candidate shall register for 160 credits and secure all the 160 credits.

b) The medium of instruction for the entire under graduate programmer in Engineering &Technology will be in **English** only.

3. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years
b) Each Academic year of study is divided into Two Semesters.
c) Minimum number of instruction days in each semester is 90.
d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
e) The total credits for the Programme is 160.
f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
g) Student is introduced to "Choice Based Credit System (CBCS)".
h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
i) A student has to register for all courses in a semester.
j) All the registered credits will be considered for the calculation of final CGPA.
k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'.Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.
l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.
m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.
n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration / career growth/placements/opportunities for higher studies/ GATE / other competitive exams etc.

4. Registration for Courses:

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.
b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen

days.

c) The concerned college shall thoroughly verify and upload the data/courses registered by each student in the university examination center within 20 days. The Principal of the concerned college shall ensure that there no wrong registration courses by the student. The university registration portal will be closed after 20 days.

5. **(a) Award of B. Tech. Degree:** A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.

ii. The student shall register for 160 credits and must secure all the 160 credits.

iii. All students shall mandatorily register for the courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure at least 40% of the marks allotted in the internal evaluation for passing the course and shall maintain 75% of attendance in the subject.

iv. All students shall mandatorily register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

v. Credits are defined as per AICTE norms.

(b) Award of B. Tech. (Honor):

- Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline
- A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.
- Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
- In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of

8/12weeks as recommended by the Board of studies.

- It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses
- The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall 16 explore the possibility of introducing virtual labs for such courses with lab component.
- MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.
- The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
- In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

(c) **Award of B. Tech. (Minors):**

- a)Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.
- The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or

industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

- The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.
- There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
- The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.
- A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.
- Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.
- A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on

such conversions and may give appropriate grades.

- If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
- In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

6. Attendance Requirements

a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.
c) Shortage of Attendance below 65% in aggregate shall not be condoned.
d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.
e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.
f) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.
g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.
h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
i) For induction programme attendance shall be maintained as per AICTE norms.
j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

7. Evaluation-Distribution and Weightage of marks

i. Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.
ii. To maintain the quality, external examiners and question paper setters shall be selected from reputed institutes like IISc, IITs, IIITs, IISERs, NITs and Universities.
iii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit

courses.

iv. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

v. **Distribution and Weightage of marks:** The assessment of the student's performance in each course will be as per the details given:

S.No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programs/Research Project	-	50	50
5	Project Work	60	140	200

vi. Continuous Internal Theory Evaluation:

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (20 multiple choice questions) for 10 marks for a duration of 20 minutes (ii) one descriptive examination (3 full questions for 5 marks each) for 15 marks for a duration of 90 minutes and (iii) one assignment for 05 marks. All the internal exams shall be conducted as per university norms from first 50% of the syllabi.

b) In the similar lines, the second online, descriptive examinations assignment shall be conducted on the rest of the 50% syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination section within one week after completion of first mid examination.

d) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

e) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

f) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

g) Internal marks can be calculated with 80% weight age for better of the two mids and 20% Weightage for other mid exam.

   a. Example: **Mid-1 marks** = Marks secured in
   b. (Online examination-1 + descriptive examination-1 +one assignment-1)
   c. **Mid-2 marks** = Marks secured in
   d. (Online examination-2+descriptive examination-2+one assignment-2)
   e. **Final internal Marks** = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-

1/Mid-2) marks x 0.2)

h) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

vii. Semester End Theory Examinations Evaluation:

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.

c) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% weightage for better of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work.

Evaluation of the summer internships:

- Two summer internships each with a minimum of six weeks duration, done at the end of second and third years, respectively are mandatory. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs.
- Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.
- In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner
- The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.
- It shall be evaluated for 50 external marks at the end of the semester. There shall

be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion.

d) Curricular Framework for Skill oriented :
   - The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.

- For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
- Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
- A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list
- The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS
- The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand
- If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.
- If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.
- A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

e) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects.

There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

f) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

g) ***Major Project (*****Project - Project work, seminar and internship in industry):**

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

Evaluation*:* The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

8 Results Declaration:

i. Before results declaration, an academic council meeting shall be conducted and results shall be placed before the academic council for approval.
ii. With the approval of academic council, the results shall be submitted to the University to get the Approval from Honorable Vice-Chancellor.
iii. The University may normalize the result, if required, before declaration of the result (Guidelines for normalization will be provided separately)
iv. A copy of approved results in a CD shall be submitted to the University examination Center.

9. Academic Audit: Academic audit in each semester will be conducted as per norms.

10. Recounting or Re-evaluation of Marks in the End Semester Examination: A student can request for recounting of revaluation of his/her answer book on payment of a prescribed fee as per norms.

11. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

12. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

13. Promotion Rules: The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.5 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.
b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.
c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

14. Course Pattern

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

15. Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

Marks Range Max:100	Marks range Max:50	Level	Letter Grade	Grade point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

16. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	Remarks

First Class with Distinction	≥7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

17. Minimum Instruction Days:

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

18. Withholding of Results:

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

19. Transitory Regulations

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.
b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.
c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.
d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions haveto obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

20. Gap – Year:

Gap Year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

21. General:

a) Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
b) The academic regulation should be read as a whole for the purpose of any interpretation.
c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
d) The University may change or amend the academic regulations 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 University.

ACADEMIC REGULATIONS (SITE21) FOR B.Tech
(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2022-23 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 122 credits and secure all the 122 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech (lateral entry)

3. **Promotion Rules:** A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. **Award of Class**

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 121 Credits from II Year to IV Year
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme**

COMMUNITY SERVICE PROJECT

Introduction

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.

3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

1. Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation
2. Each class/section should be assigned with a mentor.
3. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc.
4. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded. The log book has to be countersigned by the concerned mentor/faculty in charge.
5. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
6. The final evaluation to be reflected in the grade memo of the student.
7. The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
8. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
9. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to

enable them to commute from their residence and return back by evening or so.
2. The Community Service Project is a twofold one –

a) First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

- Agriculture
- Health
- Marketing and Cooperation
- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES **BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

Learning Outcomes

1. Positive impact on students' academic learning.
2. Improves students' ability to apply what they have learned in "the real world".
3. Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
4. Improved ability to understand complexity and ambiguity.

Personal Outcomes

1. Greater sense of personal efficacy, personal identity, spiritual growth, and moral development.
2. Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

1. Reduced stereotypes and greater inter-cultural understanding
2. Improved social responsibility and citizenship skills
3. Greater involvement in community service after graduation

Career Development

1. Connections with professionals and community members for learning and career opportunities
2. Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

1. Stronger relationships with faculty
2. Greater satisfaction with college
3. Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

1. Satisfaction with the quality of student learning
2. New avenues for research and publication via new relationships between faculty and community
3. Providing networking opportunities with engaged faculty in other disciplines or institutions
4. A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

1. Improved institutional commitment
2. Improved student retention
3. Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

1. Satisfaction with student participation
2. Valuable human resources needed to achieve community goals
3. New energy, enthusiasm and perspectives applied to community work
4. Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programs
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture

11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programs and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complementing the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs are;

Programs for School Children:

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's' Rights
3. Domestic Violence
4. Prevention and Control of Cancer

5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharat
7. AIDS awareness camp
8. Anti-Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programs
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programs
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –

    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

1. Students may not have the expertise to conduct all the programmes on their own. The students thencan play a facilitator role.

2. For conducting special camps like Health related, they will be coordinating with the Governmental agencies.

3. As and when required the College faculty themselves act as Resource Persons.
4. Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
5. And also, with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
6. An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

a) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
b) A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (Two Weeks)

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Four Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

Course Numbering Scheme

The Course number code consists of 11alphabets. A typical course number code is illustrated in the followingFigure-1.

Information Technology (IT)

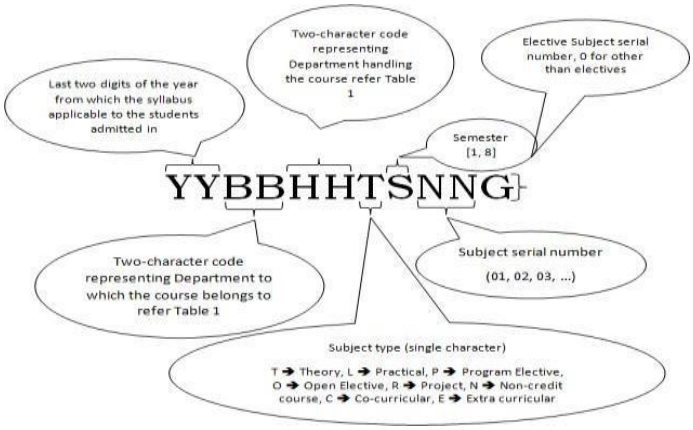


Figure 1: Course Numbering Scheme

The department codes are in given in following table 1.

Table 1: Department Codes

Department	Two-character code
Artificial Intelligence and Machine Learning	AM
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communications Engineering	EC
Electronics & Communications Technology	ET
Computer Science and Engineering	CS
Computer Science and Technology	CT
Information Technology	IT
Management Science	MS
Mathematics	MA
Physics	PH
Chemistry	CH
English	EG
Biology	BI
Common to All Branches	CM

Example: DS in 2nd semester for IT with S.No 5

S. No.	Category	No. of Credits	
		CSE/IT/CST	
		AICTE	Approved
1	Humanities and Social Sciences	12	11
2	Basic Science courses	24	26
3	Engineering Science courses	29	29.5
4	Professional Core courses	49	48.5
5	Professional Elective Courses	18	18
6	Open elective courses	12	12
7	Project work , Seminar and Internship	15	15
8	Mandatory Courses	-	-
Total Credits		159	160

Table 2: Comparison of Number of credits given by AICTE and Approved creditsMalpractice

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMS

S. No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1. (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators,	Expulsion from the examination hall and cancellation of the performance

	palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	in that subject and all other subjects the candidate 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.The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the 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 candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate 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 or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate 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	Cancellation of the performance in that subject.

	the examiners or writes to the examiner requesting him to award pass marks.	
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the 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, either spoken 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 tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate 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 candidate 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 candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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.
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 candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

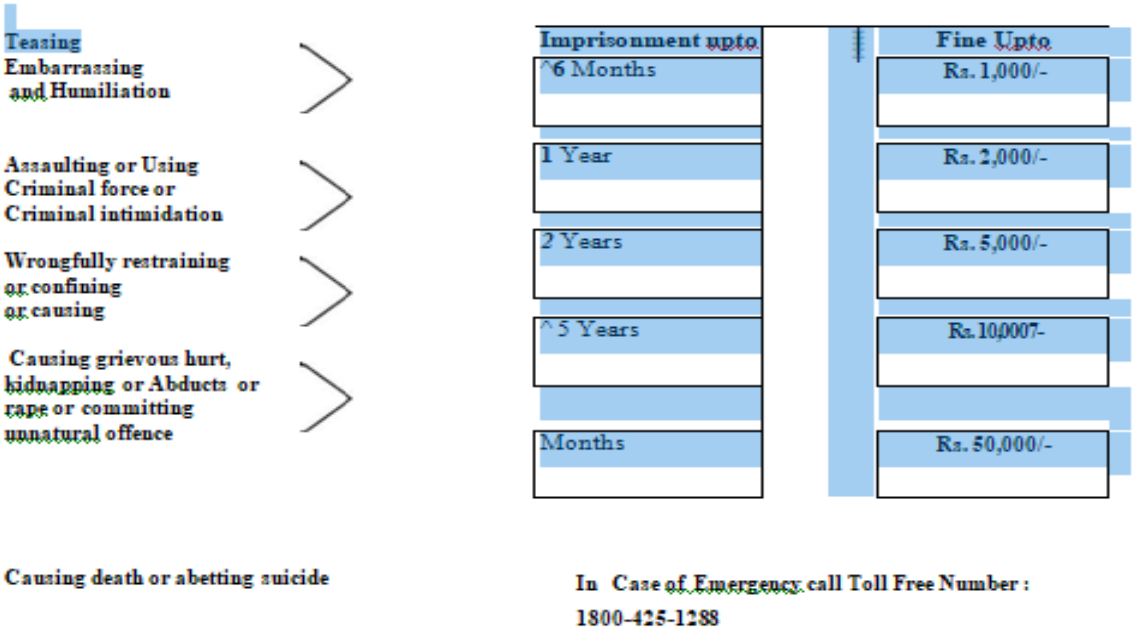
MALPRACTICES

- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of student at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997 Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.



LET US MAKE SITE RAGGING FREE INSTITUTE

Program Outcomes for an Engineering Graduates:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge

to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SITE 21

COURSE STRUCTURE AND DETAILED SYLLABUS

for

I &II B.Tech.

in

Computer Science & Engineering

(Common to CSE/IT/CST)

COURSE STRUCTURE for B. Tech. (IT)

Semester I (First yearI -I)

S.No	SubjectCode	Course	Hours			Credits
			L	T	P	
1	21CMEGT1010	Technical English	3	0	0	3
2	21CMMAT1020	Engineering Mathematics - I	3	0	0	3
3	21CMEET1030	Basic Electrical Engineering	3	0	0	3
4	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	21CSMEL1050	Computer Aided Engineering Graphics	2	0	2	3
6	21CMEGL1060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL1070	Basic Electrical Engineering Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMESN1090	Environmental Science	2	0	0	0
		Total	**16**	**0**	**11**	**19.5**

Semester II (First year I -II)

S. No	Subject Code	Course	Hours			Credits
			L	T	P	
1	21CMMAT2010	Engineering Mathematics - II	3	0	0	3
2	21CSPHT2020	Engineering Physics	3	0	0	3
3	21CMCHT2030	Engineering Chemistry	3	0	0	3
4	21CMCST2040	Python Programming	1	0	4	3
5	21CSCST2050	Data Structures	3	0	0	3
6	21CSPHL2060	Engineering Physics Lab	0	0	3	1.5
7	21CMCHL2070	Engineering Chemistry Lab	0	0	3	1.5
8	21CSCSL2080	Data Structures Lab	0	0	3	1.5
9	21CMMSN2090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
		Total	**16**	**0**	**11**	**19.5**

Semester III (Second year II-I)

S. No	Code	Course Title	Hours			Credits
			L	T	P	
1	21CMMAT3010	Probability Distributions & Statistical Methods	3	0	0	3
2	21CSECT3020	Analog & Digital Electronics	3	0	0	3
3	21CSCST3030	Computer Organization	3	0	0	3
4	21CSCST3040	Java Programming	3	0	0	3
5	21CSCST3050	Data Base Management Systems	3	0	0	3
6	21CSCSL3060	Analog &Digital Electronics Lab	0	0	3	1.5
7	21CSCSL3070	Java Programming Lab	0	0	3	1.5
8	21CSCSL3080	Data Base Management Systems Lab	0	0	3	1.5
9	21CSCSS3090	Data Science Using Python	0	0	3	2
10	21CMBIN3100	Biology for Engineers	2	0	0	0
Total			**17**	**0**	**12**	**21.5**

Semester IV (Second year II-II)

S.No	Code	Course Title	Hours			Credits
			L	T	P	
1	21CMMAT4010	Discrete Mathematics	3	0	0	3
2	21CMMST4020	Engineering Economics & Financial Management	3	0	0	3
3	21CSCST4030	Operating systems	3	0	0	3
4	21CSCST4040	Design and Analysis of Algorithms	3	0	0	3
5	21CSCST4050	Software Engineering	3	0	0	3
6	21CSCSL4060	Operating systems Lab	0	0	3	1.5
7	21CSCSL4070	Design and Analysis of Algorithms Lab	0	0	3	1.5
8	21CSSCL4080	Software Engineering Lab	0	0	3	1.5
9	21CSCSS4090	MEAN Stack Technologies	2	0	0	2
Total			**17**	**0**	**9**	**21.5**

Department of Computer Science & Engineering

Detailed Syllabus

Semester –I (I-I)

TECHNICAL ENGLISH			
Subject Code	21CMEGT 1010	IA Marks	30
Number of Lecture Hours/ Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exams Hours	03
Credits -03			

Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:

1. Technical English Vocabulary
2. Writing Skills
3. Common Errors in Writing
4. Nature and Style of Sensible Technical Writing
5. Writing Technical Reports and Letters

Unit I	
Principles of Scientific Vocabulary • Principles of Scientific vocabulary: short and simple words- compact substitutes for wordy phrases- redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words • The role of roots in word building, prefixes and suffixes, confusing words and expressions.	10 Hours
Unit II	
Writing Skills • Distinguishing between academic and personal styles of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing • Measuring the clarity of a text through Fog Index or Clarity Index	10 Hours
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • Avoiding the pitfalls	10 Hours
Unit IV	
Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying	10 Hours

• Effective use of charts, graphs, and tables	
Unit V	
Report writing and Letter writing • Writing Technical Reports • Précis writing • Letter Writing • Essay writing	10 Hours

Text Books

1. Effective Technical Communication by Barun K Mitra, Oxford University Publication

Non-detailed Text

1. Karmayogi: A Biography of E Sreedharan by M S Ashokan

Reference Books

1. *Communication Skills* by Sanjay Kumar & Pushpa Latha, OUP
2. Study Writing by Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian 2007
4. Practical English Usage by Michael Swan Oxford University Press
5. English Collocations in Use by Michael McCarthy & Felicity O'Dell
6. Effective Technical Communication by Arsahf Rizvi,
7. Essential English Grammar by Raymond Murphy, CUP, 2017

Course Outcomes : On Completion of the course student will acquire	
CO1	Ability to understand Scientific vocabulary and use them confidently
CO2	Familiarity with the basic principles of writing clear sentences and paragraphs
CO3	Ability to write error free simple technical passages
CO4	Knowledge of writing different writing styles
CO5	Confidence to write letters and technical reports clearly and coherently

ENGINEERING MATHEMATICS-I
(Calculus & Differential Equations)
Common to all the branches

Subject Code	21CMMAT1020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

1. To solve the differential equations related to various engineering fields
2. To enlighten the learners in the concept of differential equations.
3. To familiarize with functions of several variables which is useful in optimization
4. To solve the partial partial differential equations of first order
5. To apply double integration techniques in evaluating areas bounded by region.

Unit -1	**Hours**
Differential Equations of first order and first degree : Linear differential equations - Bernoulli's equations – Exact equations and Equations reducible to exact form. Applications: Newton's law of cooling - Law of natural growth and decay - Orthogonal trajectories.	**10**
Unit -2	
Linear differential equations of higher order : Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^n V(x) – Method of Variation of parameters. Applications: LCR circuit.	**10**
Unit – 3	
Partial differentiation: Introduction – Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method.	**10**
Unit – 4	
PDE of first order: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.	**08**
Unit – 5	
Multiple integrals: Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates. Applications: Finding Areas and Volumes.	**12**

Text Books/ Reference Books:

T1	B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
T2	B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

R1	Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
R2	Joel Hass, Christopher Heil and Maurice D. Weir, Thomas calculus, 14thEdition, Pearson.
R3	Lawrence Turyn, Advanced Engineering Mathematics, CRC Press, 2013.
R4	Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

Course outcomes: On completion of this course, students are able to	
CO1	Solve the differential equations related to various engineering fields (L3)
CO2	Solve the differential equations of higher order related to various engineering fields (L3)
CO3	familiarize with functions of several variables which is useful in optimization (L3)
CO4	Solve the partial partial differential equations of first order (L3)
CO5	Apply double integration techniques in evaluating areas bounded by region (L3).

Basic Electrical Engineering Common for ECE, CSE, IT/ CE, EEE, ME, ECT, CST, AI & ML			
Subject Code	21CMEET1030	IA Marks	30
Number of Lecture Hours/Week	3L + 1T	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits-03			

Course Objectives:

This course will enable student to

1. Understand basic electrical circuit operation.
2. Understand the concept of Alternating Voltage and Current.
3. Understand the operation of DC machines.
4. Understand the working of measuring instruments.
5. Understand the operation of different types of ac machines.
6. Understand the concept of Electrical Safety.

Unit -1	**Hours**
Basic Electrical Circuits: Basic definitions(Electric Charge, Current, Electro Magnet Force, Potential Difference; Electric Power and Energy) – types of network elements – Ohm's Law – Kirchhoff's Laws –series & parallel circuits - network theorems (Super position, Thevinen's, Norton's, Maximum power transfer theorems)	**10**
Unit -2	
AC Fundamentals & Basic Electromagnetic Laws: Study of AC Voltage and Current, RMS and Average Values, Three phase Star-Delta connections, Alternating Voltage applied to Pure Resistance, Inductance, Capacitance and their combinations, Concept of Power and Power Factor in AC Circuit. Concept of Magnetic Field, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws,	**10**
Unit – 3	
DC Machines: DC Machine -Principle of operation & construction – emf equation- torque equation - speed control methods – losses and efficiency – brake test. applications of DC motors.	**10**
Unit – 4	
AC Machines: Single Phase Transformers - Construction and Operation- Principles - Classification - Applications-OC & SC test of single phase transformer-regulation & Efficiency. Three Phase Induction Motors: working principle- construction, speed- torque characteristics-losses and efficiency.	**10**
Unit – 5	
Electrical Safety: Electrical Shock and Precautions against it, Treatment of Electric Shock; Concept of Fuses and Their Classification, Selection and Application; Concept of Earthing.	**10**

Text Books / Reference Books:	
T1	Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group.
T2	Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand and Company Limited.
R1	Theory and Performance of Electrical Machines by J.B. Gupta, S.K.Kataria & Sons.
R2	A Textbook of Electrical Technology – Volume II: AC & DC Machines by B.L.Theraja & A.K. Theraja, S.Chand and Company Limited.
R3	Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.
R4	Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
R5	Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
R6	Electrical Technology by Surinder Pal Bali, Pearson Publications.

Course Outcomes: The student should be able to	
CO1	Understand basic electrical circuit operation.
CO2	Understand the concept of Alternating Voltage and Current.
CO3	Understand the operation of DC machines.
CO4	Understand the working of measuring instruments.
CO5	Understand the operation of different types of ac machines.

PROGRAMMING FOR PROBLEM SOLVING			
Subject Code	21CMCST1040	IA Marks	30
Number of Lecture hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits -03			

Course Objectives:

The Objectives of Programming for problem solving are:

- To learn about C programming language syntax, semantics, and the runtime environment.
- To be familiarized with general computer programming concepts like data types, conditional statements, loops and functions.
- To be familiarized with general coding techniques and procedure-oriented programming.

UNIT I	**Hours**
History& Hardware: (TB 1: 1-22) Computer Hardware, Components, Types ofSoftware, Memory Units. **Introduction to Problem solving:(TB1:33-50)** Algorithm, Characteristics of Algorithms, Basic Operations of Algorithms, Pseudo Code, Flowchart, Types of Languages, Relation between Data, Information, Input and Output. **Basics of C: (TB1:58-67)**History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program Development Steps, Programming Errors.	**10**
UNIT II	
Overview of C:(TB:68-125) Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator Precedence and Associativity, Converting Mathematical Expressions to C-expressions, Evaluation of C-Expressions, Input/Output Functions. **Conditional Branching:(TB1:143-152)** if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement. **Unconditional Branching:(TB1:174-175)** goto. Control flow Statements: break, continue. **Looping Constructs:(TB1:156-170)** do-while statement, while statement, for statement.	**10**
UNIT III	
Arrays:(TB1:188-222) Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi-Dimensional Arrays. **Strings:** Working with Strings, String Handling Functions (both library and user defined). **Functions:(TB1:230-260)** Basics, Necessity and Advantages, Types of Functions, Parameter Passing Mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and Vice-Versa.	**8**
UNIT IV	
Pointers:(TB1:288-347) Understanding Pointers, Pointer Expressions, Pointer and Arrays,	**12**

Pointers and Strings, Pointers to Functions. Dynamic Memory Allocation: Introduction to Dynamic Memory Allocation- malloc (), calloc (), realloc (), free (). **Structures and Unions:(TB1:370-394)** Defining a Structure, typedef, Advantage of Structure, Nested Structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures and Pointers, Defining Unions, Union within Union, Structure within Union, Union within Structure, Self-Referential Structures, Bitfields, Enumerations.	
UNIT V	
Preprocessing Directives:(TB2:325-333) Macro Substitution, File Inclusion, Conditional Compilation and Other Directives **File Management In C:(TB1:408-422)** Introduction to File Management, Modes and Operations on Files, Types of Files, Error Handling during I/O Operations.	**10**

Text Books/ Reference Books:	
T1	Programming in C ,Pradip Dey,Manas Ghosh, OXFORD
T2	Programming in ,C Reema Thareja,Second Edition, OXFORD
T3	Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.
R1	Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
R2	Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson

Course Outcomes: Student can able to	
CO1	Demonstrate computer components, algorithms, translate them into programs.
CO2	Choose thesuitable control structures for the problem to besolved.
CO3	Make use of arrays, pointers, structures,and unions effectively.
CO4	Organize reusable code in a program into functions.
CO5	Demonstration of file operations.

COMPUTER AIDED ENGINEERING GRAPHICS			
Subject Code	21CSMEL1050	IA Marks	30
Number of Lecture Hours/Week	1(L)+0(T)+4(P)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits – 03			

COURSE OBJECTIVES: On successful completion of this course,
Students should be able to

1. draw engineering objects with appropriate lettering and dimensioning using various commands of AutoCAD
2. draw geometric constructions, polygons, various types of curves and scales
3. construct multi views of points, lines and planes
4. construct multi views of solids by orthographic projection method
5. convert the orthographic views into isometric views and vice versa by 2D- Commands in AutoCAD

Unit -1: INTRODUCTION	**Hours**
Introduction to Engineering Graphics, sheet sizes & layouts (ISO), line types with application, scales, drawing sheet sizes, title block, sheet markings, dimensioning **AutoCAD:** Overview of Computer Graphics, starting with autoCAD, templates, menu- bar, drawing area, option buttons (drawing settings), command line area, draw commands (point, line, polyline, circle, circular arc, ellipse, elliptical arc, spline fit, spline CV, rectangle &polygon), modify commands (move, rotate, trim/extend, erase, copy, mirror, chamfer/ fillet, explode, stretch, scale, array & offset), layers (layering, setting up and use of layers, layers to create drawings and create, edit and use customized layers) &annotation commands (applying dimensions/ annotations to drawings), drawing settings (grid, snap-mode, ortho, polar tracking, object snap, iso-draft), dimension settings (edit/ modify dimension style: text size & style, arrow size & style, line types & thickness and setting other parameters of dimension text, dimension lines & extension lines) Printing documents to paper and to PDF using plot command.	**12**
Unit -2: CONICS AND SCALES	
Geometrical constructions, polygons, conic sections – ellipse, parabola, hyperbola (Eccentricity method only); scales – plain, diagonal and vernier scales**.**	**10**
Unit – 3: ORTHOGRAPHIC PROJECTION OF POINTS, LINE AND PLANES	
Principles of Orthographic Projections, Projections of Points, projection of lines (inclined to HP & VP); Projections of planes (inclined to one reference plane).	**10**
Unit – 4: ORTHOGRAPHIC PROJECTION OF SOLIDS	
Projections of Regular Solids- Prisms, Pyramids, Cylinder & Cone (simple position and inclined to one reference plane only)	**8**
Unit-5: ISOMETRIC PROJECTIONS AND ORTHOGRAPHIC VIEWS	
Isometric Projections and orthographic views: Principles of isometric projection – isometric scale, isometric views, conventions; isometric views of lines, planes, simple solids, Conversion of Isometric Views to Orthographic Views and vice-	**10**

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Text Books/ Reference Books:	
T1	N.D. Bhatt & V.M. Panchal, Engineering Drawing, 48th edition, 2005, Charotar Publishing House, Gujarat
T2	R.B.Choudary, Engineering Drawing with AutoCAD 2008, Anuradha Publishers
R1	S. Trymbaka Murthy, Computer Aided Engineering Drawing, I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition 2006.
R2	K.R. Gopalkrishna, Engineering Graphics, 32nd edition, 2005 Subash Publishers, Bangalore

COURSE OUTCOMES: On successful completion of this course, students will be able to	
CO1	understand the BIS conventions of engineering drawing with basic concepts&draw engineering objects with appropriate lettering and dimensioning using various commands of AutoCAD
CO2	construct polygons, various types of Curves and scales used engineering application like maps, buildings, bridges
CO3	draw multi views of points, lines and planes by orthographic projection method
CO4	draw multi views of solids by orthographic projection method
CO5	convert the orthographic views into isometric views and vice versa by 2D- Commands in AutoCAD

English Communication Skills Lab			
Subject Code	21CMEGL1060	IA Marks	15
Number of Practical Hours/Week	03	Exam Marks	35
Total Number of Practical Hours	36	Exam Hours	03
Credits – 1.5			

Objectives: To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentations

List of Experiments

UNIT I Listening Comprehension
UNIT II Pronunciation , Stress, Intonation & Rhythm
UNIT II Common Everyday Situations: Conversations & Dialogues; Communication at Workplace: Job Application letter, Email & Resume
UNIT IV Interpersonal Communication Skills-
UNIT V Formal Presentations

Outcomes:

By the end of the course the students will be able toacquire basic Proficiency in English by practicing the following:

1. Listening Comprehension
2. Pronunciation
3. Dialogues
4. Interpersonal Communication Skills
5. Presentations

Learning Resources:

1. Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan
2. Ted Talks, Interviews with Achievers and select movies
3. Toastmaster's speeches and table topics
4. Book Reviews and movie reviews
5. Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad.
6. Oxford Guide to Effective Writing and Speaking by John Seely
7. https://www.ted.com/talk

Basic Electrical Engineering Laboratory Common for ECE, CSE, IT/ CE, EEE, ME, ECT, CST, AI & ML			
Subject Code	21CMEEL1070	IA Marks	50
Number of Lecture Hours/Week	3P	Exam Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits-1.5			

Course Objectives:

This course will enable the student to

1. Verify the Kirchoff'slaws, network theorems for a given circuit.
2. Analyze the performance of DC shunt generator.
3. Control the speed of DC motor.
4. Predetermine the efficiency DC machine.
5. Analyze performance of three phase induction motor.
6. Determine the regulation of an alternators.

List of Experiments(Any ten experiments must be conducted)

1. Verification of Kirchoff'slaws.
2. Verification of Thevenin's Theorem.
3. Verification of Norton's Theorem.
4. Verification of Superposition theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Speed control of D.C. shunt motor.
7. Brake test on DC shunt motor.
8. Calibration of wattmeter.
9. OC & SC tests on single-phase transformer.
10. Brake test on 1-phase Induction motor.
11. Brake test on 3-phase Induction motor.
12. Study experiment on Ear thing.

COURSE OUTCOMES: On completion of the course student will be able to:	
CO1	Verify the Kirchoff'slaws.
CO2	Verify network theorems for a given circuit.
CO3	Control the speed of DC motor.
CO4	Analyze performance of single phase induction motor
CO5	Analyze performance of three phase induction motor.
CO6	Identify different types of earthings

PROGRAMMING FOR PROBLEM SOLVING LAB			
Subject Code	21CMCSL1080	IA Marks	15
Number of Lecture hours/Week	3	Exam Marks	35
Total Number of Lecture Hours	48	Exam Hours	03
Credits -1.5			

Course Objectives:

1. To understand the various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs.
4. To learn to write programs (using structured programming approach) in C to solve problems.
5. To introduce basic data structures such as lists, stacks and queues.

Exercise 1 (Familiarization with programming environment)

a) Familiarization of CODE BLOCKS C++ Editor to edit, compile, execute, test and debugging C programs.
b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control.
c) Acquaintance with basic LINUX commands.

Exercise 2 (Simple computational problems using arithmetic expressions)

a) Write a C Program to display real number with 2 decimal places.
b) Write a C Program to convert Celsius to Fahrenheit and vice versa.
c) Write a C Program to calculate the area of triangle using the formula
area = $\sqrt{}$ (s(s−a)(s−b)(s −c) where s=a+b+c/2.

d) Write a C program to find the largest of three numbers using ternary operator.
e) Write a C Program to swap two numbers without using a temporary variable.

Exercise 3 (Problems involving if-then-else structures)

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shift operator and arithmetic operator.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C Program to display grade based on 6 subject marks using if…else…if ladder.
d) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result using switch control statement.(Consider the operators +, -,*,/, %)

Exercise 4 (Iterative problems)

a) Write a C Program to count number of 0's and 1's in a binary representation of a given number.
b) Write a C program to generate all the prime numbers between two numbers supplied by the user.
c) Write a C Program to print the multiplication table corresponding to number supplied as input

Exercise 5 (Iterative problems)

a) Write a C Program to Find Whether the Given Number is i)Armstrong Number ii)

Palindrome Number

b) Write a C Program to print sum of digits of a given number

Exercise 6 (Series examples)

a) Write a C Program to calculate sum of following series
b) 1+2+3+…. n b)1+1/2+1/3+……+1/n c)1+x+x2+x3……+xn

Exercise 7 (1D Array manipulation)

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array SA SASSASI

Exercise 8 (Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message "incompatible matrix sizes" otherwise.
c) Write a C program to check given matrix is symmetric or not.
d) Implement the following string operations with and without library functions. i)copy

ii) concatenate iii) lengthiv) compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
   i. With arguments and with return value.
   ii. With arguments and without return value.
   iii. Without arguments and without return value.
   iv. Without arguments and with return value.

b) Write a C Program illustrating call by reference.

Exercise 10 (Recursive functions)

Write a C Program illustrating the following with Recursion without Recursion

a) Factorial b) GCD c) Power d) Fibonacci

Exercise 11(Pointers and structures)

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

Note: Understand the difference between the above two programs.

c)Write a C Program to read and print student details using structures.

Exercise 12 (File operations)

a) Write a C program to open a file and to print it contents on screen.
b) Write a C program to copy files.
c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

Course Outcomes:	
CO1	Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems.

CO2	Examine and analyze alternative solutions to a problem.
CO3	Design an algorithmic solution to a problem using problem decomposition and step- wise refinement.
CO4	Demonstrate conversion of iterative functions to recursive and vice-versa.
CO5	Implement the concepts of arrays, structures, Unions and files.

ENVIRONMENTAL SCIENCE			
Subject Code	21CMESN1090	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	32	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Acquire knowledge on global environmental challenges.
2. Learn different types of natural resources
3. Create awareness on biodiversity and ecology.
4. Gain scientific knowledge on environmental pollution
5. Acquire knowledge on water conservation methods and environmental legislation

Module -1	**Hours**
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **Environment -** Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Role of Information Technology in Environment and human health.	**6**
Module -2	
NATURAL RESOURCES Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use, deforestation - Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Floods, drought, , dams – benefits and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: Effects of modern agriculture - fertilizer-pesticide problems, water logging, eutrophication, biological magnification and salinity. Energy resources: Renewable and non-renewable energy resources Role of an individual in conservation of natural resources.	**6**
Module – 3	
ECOSYSTEM AND BIODIVERSITY **Ecosystem** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the Forest and grassland ecosystem. **Biodiversity** - Introduction - Definition: genetic, species and ecosystem diversity. – Value of biodiversity: consumptive use, productive use, social, ethical and optional values - Hot-spots ofbiodiversity - Threats to biodiversity: habitat loss - Endangered andendemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**8**
Module – 4	

ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution c. Soil pollution d. Noise pollution e. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.	**6**
Module – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act -Wildlife Protection Act - Forest Conservation Act .	**6**

TEXT BOOKS/ REFERENCE BOOKS:	
T1	E. Bharucha (2003), "Environmental Studies", University Publishing Company, New Delhi.
T2	J.G. Henry and G.W. Heinke (2004), "Environmental Science and Engineering", Second Edition, Prentice Hall of India, New Delhi.
T3	G.M. Masters (2004)" Introduction to Environmental Engineering and Science", Second Edition, Prentice Hall of India, New Delhi
R1	Text Book of Environmental Studies by Deeksha Dave & P. Udaya Bhaskar, Cengage Learning.
R2	Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
R3	Environmental Studies, P.N. Palaniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

COURSE OUTCOMES: On completion of the course student will be able to	
CO1	Obtain knowledge on global warming & climate change - Acid rains, ozone layer depletion.
CO2	Preserve several natural resources
CO3	Summarize the concept of ecosystem
CO4	Control different types of pollution
CO5	Understand social issues and environmental legislation

Semester –II (I-II)

ENGINEERING MATHEMATICS-II (Linear algebra, Laplace transforms & Numerical Methods) Common to all the branches			
Subject Code	21CMMAT2010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course objectives:

To enable students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following'

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications and solve system of linear equations
2. To find the inverse and power of a matrix by Cayley-Hamilton theorem and reduce the Quadratic form
3. To solve initial value problems by using Laplace transforms
4. To find the solution of algebraic/ transcendental equations and also interpolate the functions.
5. To apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations.

Unit -1	**Hours**
Solving systems of linear equations: Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non homogeneous linear equations – Gauss Elimination method- Jacobi and Gauss-Seidel methods for solving system of equations numerically.	**10**
Unit -2	
Eigen values and Eigen vectors, Cayley–Hamilton theorem and Quadratic forms: Eigen values and Eigen vectors and properties- Cayley-Hamilton theorem (without proof) – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation, Diagonalisation and Lagrange's reduction	**10**
Unit – 3	
Laplace Transforms: Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta function Periodic function – Inverse Laplace transforms– Convolution theorem (without proof). Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.	**10**
Unit – 4	
Numerical Methods: Introduction - Method of false position - Newton-Raphson method (One Variable) Introduction– Errors in polynomial interpolation – Finite differences– Forward differences– Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula.	**10**
Unit – 5	
Numerical integration, Solution of ordinary differential equations with initial conditions: Trapezoidal rule - Simpson's 1/3rd and 3/8th rule - Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge -Kutta method (second and fourth order).	**10**

Course outcomes: On completion of this course, students are able to,	
CO1	Develop the use of matrix algebra techniques that is needed by engineers for practical applications and solve system of linear equations (L6)
CO2	Find the inverse and power of a matrix by Cayley-Hamilton theorem and reduce the Quadratic form (L3)
CO3	Solve initial value problems by using Laplace transforms (L3)
CO4	Find the solution of algebraic/ transcendental equations and also interpolate the functions(L3)
CO5	Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3).

Text Books / Reference Books:	
T1	B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
T2	Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.
T3	B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006
R1	Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, “Engineering Mathematics, Volume II” Scitech Publications, 2017.
R2	Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata McGraw Hill Education, 4th Edition, 2018
R3	M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications, 3rd Edition, 2020.
R4	Lawrence Turyn, Advanced Engineering Mathematics, CRC Press, 1st Edition 2014.

ENGINEERING PHYSICS
(Semiconductor Physics & Semiconductor Optoelectronics)
(Common for CSE and IT in II-Semester)

Subject Code	21CSPHT2020	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To impart** the knowledge of Quantum mechanics for understanding the conducting mechanism in solids.
- **To understand** the physics of semiconductors and their working mechanism for their utility.

Unit -1	**Hours**
Quantum Mechanics: Dual nature of matter, Significance and properties of wave function, Schrodinger time independent wave equations, Particle in a one dimensional infinite potential well. **Free Electron Theory and Band theory:** Classical free electron theory (Qualitative with discussion of merits and demerits), Quantum free electron theory, Equation for electrical conductivity based on quantum free electron theory, Fermi-Dirac distribution, Density of states (3D), Fermi energy; Band theory of Solids -Bloch's theorem; Kronig - Penney model (Qualitative), Effective mass of electron.	**12**
Unit -2	
Semiconductors: Introduction; Intrinsic semiconductors- Density of charge carriers,Electrical conductivity, Fermi level; Extrinsic semiconductors- density of charge carriers, dependence of Fermi energy on carrier concentration and temperature; Drift and diffusion currents- Einstein's equation; Hall effect- Hall coefficient- Applications of Hall effect.	**11**
Unit – 3	
Light interaction with matter: Stimulated absorption, spontaneous emission, and stimulated emission,Einstein coefficients, Population inversion,Characteristics of lasers, Pumping mechanisms- Ruby laser, He-Ne laser, Direct and indirect band gap semiconductors, Optical transitions in bulk semiconductors Construction and working of laser diode and their applications.	**10**
Unit – 4	
Semiconductor light emitting diodes (LEDs) : Injection Electro luminescence; Construction and working of LED, characteristics of LED's - Internal efficiency,Extraction efficiency, External Efficiency, Power conversion efficiency, Responsivity &I V characteristics, Double junction Hetero structure and its importance, LED configurations-SLED's and ELED'S, applications of LEDs.	**9**
Unit – 5	
Photo diodes: Introduction- construction and working principle of PN photodiode, P-i-N photodiode, and Avalanche photodiode (APD), and their IV characteristics, Photovoltaic effect, construction and working of Solar cell, fill factor and efficiency of solar cell.	**8**

TEXT BOOKS / REFERENCE BOOKS:	
T1	S.O. Pillai, Solid state physics, New age publications.
T2	B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons,
T3	A Text Book of Engineering Physics- M.N.Avadhanulu, 11e , S.CHAND,
R1	Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning publications.
R2	P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
R3	Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
R4	Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

COURSE OUTCOMES: On completion of the course student will able to	
CO1	Understand the theoretical view of electrical conductivity in metals using free electron theory and quantum mechanics.
CO2	Estimate the statistical calculation and the theoretical view of charge carrier’s density in semiconductors.
CO3	Generalization ofthe light-matter interaction mechanisms.
CO4	Describe the basic laser physics and working of lasers.
CO5	Illustrate the construction and working function of LEDs.
CO6	Analyze the construction and working of photo diodes and solar cells.

ENGINEERING CHEMISTRY			
Subject Code	21CMCHT2030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:
The objectives of this course, help the students to

1. Explain the mechanism of corrosion
2. Interpret various boiler troubles and importance of water quality standards.
3. Learn preparation of semiconducting materials, nanomaterials and liquid crystals – their applications
4. Acquire knowledge on nonconventional energy resources and different types of batteries
5. Know various spectroscopic techniques.
6. Acquire knowledge on volumetric analysis.

Module-1	**Hours**
Electrochemistry and Corrosion **Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. **Corrosion:** Introduction, Mechanism of Wet chemical corrosion, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	**9**
Module -2	
Water Chemistry and Surface Properties **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, Hardness of water, Temporary and Permanent hardness, Units, determination of hardness by complexometric method. Boiler troubles, Caustic Embrittlement, Priming and foaming, Boiler corrosion. Break point chlorination. **Surface properties:** Determination of surface tension and viscosity of liquids.	**9**
Module -3	
Material Chemistry **Non-elemental semiconducting materials:** Stoichiometric, controlled valency and chalcogen photo/semiconductors and preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion and ion implantation). **Liquid crystals:** Introduction, types and applications. **Nanoparticles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – Preparation of carbon nanotubes (Arc discharge, chemical vapour deposition and laser ablation methods) properties and applications.	**10**

Module – 4	
ENERGY SOURCES: **Non-conventional energy sources,** Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell,hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion. **Batteries and fuel cells:** Primary and secondary batteries - Dry cell, Lead Acid Cell, Lithium ion battery and Zinc air cells and fuel cells - H_2-O_2, CH_3OH-O_2, Phosphoric acid and molten carbonate.	**10**
Module – 5	
SPECTROSCOPY AND CHROMATOGRAPHY TECHNIQUES Regions of electromagnetic spectrum - Principles of vibrational and rotational spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – Thin Layer & Paper Chromatography.	**10**

COURSE OUTCOMES: On completion of the course student will be able to	
CO1	Interpret the mechanism of corrosion
CO2	Summarize the problems faced in industries due to boiler troubles.
CO3	Recall the properties and applications of advanced materials.
CO4	Summarize the advantages of non-conventional energy resources and batteries.
CO5	Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
CO6	Determine the strength of acid, base and some elements by volumetric and instrumental analysis.

TEXT BOOKS / REFERENCE BOOKS:	
T1	P.C. Jain and M. Jain "**Engineering Chemistry**", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
T2	Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
T3	S.S. Dara, "**A Textbook of Engineering Chemistry**", S.Chand & Co, (2010).
T4	Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).
T5	Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
R1	K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
R2	O.G. Palana, "**Engineering Chemistry**", Tata McGraw Hill Education Private Limited, (2009).

R3	CNR Rao and JM Honig (Eds) "**Preparation and characterization of materials**" Academic press, New York (latest edition)

PYTHON PROGRAMMING			
Subject Code	21CMCST2040	IA Marks	30
Number of Lecture hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits -03			

Course Objectives:

The Objectives of Python Programming are:

- To learn about Python programming language syntax, semantics, and the runtime environment.
- To be familiarized with general computer programming concepts like data types, conditional statements, loops and functions.
- To be familiarized with general coding techniques and object-oriented programming and Graphical User Interfaces.

UNIT I	**Hours**
Introduction:(TB1:22-30, TB2:1.1-1.4, TB2:1.21-1.33) Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Variables, Reading Input from the Keyboard, Operators. **Data Types, and Expression: (TB1:41-59)** Strings Assignment, and Comment, Numeric Data Types andCharacter Sets, Type conversions, Expressions, Using functions and Modules. **Decision Structures and Boolean Logic:(TB1:77-85)** if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.	**10**
UNIT II	
Control Statement:(TB1:65-72, TB1:86-91) Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration, The While Loop, Nested Loops. **Strings and Text Files:(TB1:103-125)** Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods, Text Files.	**8**
UNIT III	
List and Dictionaries:(TB1:135-145, TB1:153-158) Lists,Tuples,Sets, Dictionaries. **Design with Function:(TB1:146-149, TB1:169-190)** Functions as Abstraction Mechanisms, Problem Solving with Top-Down Design, Design with Recursive Functions, Case Study Gathering Information from aFile System. **Modules**: **(TB2:8.1-8.5)** Modules, Standard Modules, Packages.	**8**
UNIT IV	
File Operations:(TB1:122-123) Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines().**Object Oriented Programming:(TB2:5.1-5.20, TB2:6.1-6.17)** Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance. **Design with Classes:(TB1:294-301, TB1:309-330)** Objects and Classes, Data modeling Examples, Case Study an ATM.	**12**

UNIT V	
Errors and Exceptions:(TB2:7.1-7.8) Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. **Graphical User Interfaces:(TB1:245-288)** The Behavior of Terminal Based Programs and GUI -Based,Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.	12

Text Books / References:	
T1	Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
T2	Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
R1	Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
R2	Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
W1	https://www.tutorialspoint.com/python3/python_tutorial.pdf

Course Outcomes: After completion of this course student will able to learn	
CO1	Explain thefundamental concepts in the Python language.
CO2	Implementation of python iterative statements and strings.
CO3	Demonstrate python lists, dictionaries, and functions.
CO4	Understand the concepts of modules and packages in python.
CO5	Complete coding challenges related to object-oriented programming.
CO6	Apply variety of error handling and GUI programming techniques.

DATA STRUCTURES			
Subject Code	21CSCST2050	IA Marks	30
Number of Lecture hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits-03			

Course Objectives:
The objective of the course is to

- Introduce the fundamental concepts of data structures and abstract data types.
- Emphasize the importance of data structures in developing and implementing efficient algorithms.
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms.

UNIT I	**Hours**
Data Structures -(RB3: 1.1-1.20) Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. **Searching(TB1: 424-434)**- Linear search, Binary search, Fibonacci search. **Sorting (TB1: 434-460)**- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.	**10**
UNIT II	
Linked List: (TB1: 162-211) Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.	**12**
UNIT III	
Queues: (TB1: 253-275) Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues, Circular Queues, Deques, Priority Queues, Multiple Queues. **Stacks:(TB1 : 219-243)**Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.	**10**
UNIT IV	
Trees:(TB1: 279-306) Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees-Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced **[Binary Trees (RB3: 7.50-7.57)**- AVL Trees, Insertion, Deletion and Rotations.]	**8**
UNIT V	
Graphs: (TB1: 383-419) Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims &Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.	**8**

Text Books / Reference Books:	
T1	Data Structures Using C. 2nd Edition. Reema Thareja, Oxford.
T2	Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.
T3	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
R1	Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A.
R2	Forouzon, Cengage.
R3	Data Structures with C, Seymour Lipschutz TMH
W1	http://algs4.cs.princeton.edu/home/
W2	https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

Course Outcomes: After completing this course a student will be able to:	
CO1	Discuss the Basics of data structures and computational efficiency of algorithms for sorting & searching.
CO2	Illustration of linked lists and its operations.
CO3	Design programs using a variety of data structures such as stacks and queues.
CO4	Demonstrate different tree traversing method.
CO5	Describing the graphs concepts.

ENGINEERING PHYSICS LAB (Common for CSE and IT)			
Subject Code	21CSPHL2060	IA Marks	15
Number of Practice Hours/Week	03	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To apply** the theoretical knowledge of Physics through hands on the experimental instruments.
- **To improve** the experimental knowledge in the later studies.
- **To understand** the basic need of experiments.
- **To know** how to measure the different physical quantities.
- **To gain** the knowledge about different electrical components and basic electrical circuits.

List of Experiments

1. Determination of the Fermi energy of copper using meter bridge.
2. Determination of the Energy band gap of P-N junction diode.
3. Study of the spectral response of photo cell-Planck's constant.
4. Study of V-I characteristics of LED (Light Emitting Diode) and to determine knee voltage, frequency of the light emitting diode.
5. Determination of the frequency of electrical vibrator-Melde's experiment.
6. Determination of the wavelength of Laser diode using diffraction.
7. Determination of the V-I characteristics of photo diode and to find the variation of photo current as a function of light intensity.
8. Study of the characteristics of a photo voltaic cell (Solar cell) and to find Fill factor and efficiency.
9. Study of the V-I characteristics of Semiconductor diode, and to determine barrier potential and forward resistance.
10. Study of the I/V Characteristics of Zener diode.

Demonstration experiments:

1. Determination of the resistivity of a semiconductor using four probes method.
2. Estimation of the Hall coefficient of a semiconductor-Hall effect.

COURSE OUTCOMES: On completion of the course student will able to	
CO1	Compare the theory and correlated with experiments.
CO2	Design experiments.
CO3	Analyze the experimental result.
CO4	Apply appropriate techniques to perform the experiments.
CO5	Understand the interaction of the light with semiconductor.
CO6	Study the characteristic curves of the optoelectronic semiconductor devices.

ENGINEERING CHEMISTRY LABORATORY			
Subject Code	21CMCHL2070	IA Marks	15
Number of Practice Hours/Week	3	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

(Any 10 experiments must be conducted)

1. Determination of HCl using standard Na2CO3 solution
2. Determination of alkalinity of a sample containing Na2CO3 and NaOH
3. Determination of surface tension
4. Determination of viscosity of a liquid by Ostwald viscometer
5. Determination of chloride content of water
6. Determination total hardness of water by EDTA.
7. Determination of Mg^{+2}using standard oxalic acid solution.
8. Determination of Cu^{+2}using standard hypo solution.
9. Determination of the rate constant of first order reaction (Ester hydrolysis)
10. Determination of strength of strong acid using conduct ometeric titration.
11. Determination of strength of weak acid using conduct ometeric titration .
12. Determination of Ferrous iron using potentiometer.
13. Chemical oscillations- Iodine clock reaction
14. Estimation of Vitamin C.

Demonstration Experiments

1. Thin Layer Chromatography
2. Determination of $Fe^{+3}$by a colorimetric method.

Data Structures Lab			
Subject Code	21CSCSL2080	IA Marks	15
Number of Lecture hours/Week	3	Exam Marks	35
Total Number of Lecture Hours	48	Exam Hours	03
Credits -1.5			

List of Experiments

Exercise -1 (Arrays and Dynamic memory allocation)

- Write C program to insert and delete the elements of one dimensional array.
- Write C program to create Dynamic memory allocation using malloc (), calloc ().
- Write C program to create Dynamic memory allocation using realloc ().

Exercise -2 (Searching)

- Write C program that use both recursive and non-recursive functions to perform Linear search for a key value in a given list.
- Write C program that use both recursive and non-recursive functions to perform Binary search for a key value in a given list.

Exercise -3 (Sorting-I)

- Write C program that implement Bubble sort, to sort a given list of integers in ascending order.
- Write C program that implement Quick sort, to sort a given list of integers in ascending order.
- Write C program that implement Insertion sort, to sort a given list of integers in ascending order.
- Write C program that implement merge sort, to sort a given list of integers in ascending order.

Exercise -4(Singly Linked List)

- Write a C program that uses functions to create a singly linked list.
- Write a C program that uses functions to perform insertion operation on a singly linked list.
- Write a C program that uses functions to perform deletion operation on a singly linked list.
- Write a C program to reverse elements of a single linked list.

Exercise -5(Queue)

- Write C program that implement Queue (its operations) using arrays.
- Write C program that implement Queue (its operations) using linked lists.

Exercise -6(Stack)

- Write C program that implement stack (its operations) using arrays.
- Write C program that implement stack (its operations) using Linked list.
- Write a C program that uses Stack operations to evaluate postfix expression.

Exercise -7(Binary Tree)

Write a recursive C program for traversing a binary tree in preorder, in order and post order.

Exercise -8(Binary Search Tree)

- Write a C program to Create a BST

- Write a C program to insert a node into a BST.
- Write a C program to delete a node from a BST

Course Outcomes: By the end of this lab the student can	
CO1	Solve various searching and sorting problems.
CO2	Making use of basic data structures such as arrays and linked list to solve problems.
CO3	Implement stacks and queues using linked list
CO4	Implement tree traversal techniques for the binary trees
CO5	Implement graph traversals, minimal spanning tree and shortest path.

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS (Common to all Branches)			
Subject Code	21CMMSN2090	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Unit - I	
Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**10**
Unit - II	
Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**10**
Unit – III	
State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**10**
Unit –IV	
Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	**10**
Unit – V	
Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**10**

TEXT BOOKS / REFERENCE BOOKS	
T1	Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001
T2	Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.
T3	M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
R1	M.Govindarajan, S.Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
R2	Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.
R3	Latest Publications of Indian Institute of Human Rights, New Delhi

COURSE OUTCOMES: On completion of the course student will	
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations.
CO2	Understand state and central policies, fundamental duties.
CO3	Understand Electoral Process, special provisions.
CO4	Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
CO5	Understand Engineering ethics and responsibilities of Engineers
CO6	Understand Engineering Integrity & Reliability

Department of Information Technology

Detailed Syllabus

Semester –III (II-I)

Probability Distributions & Statistical Methods			
Subject Code	21CMMAT3010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

To apply least squares method to fit a curve.
To Analysis the data and evaluate the central tendency of data.
To know the Basic Concepts of Probability and corresponding distributions
To obtain the estimate of a parameter from sample statistic
To test the hypothesis.

Unit -1	**Hours**
Curve fitting: Method of least squares – fitting to Straight line – parabola – Exponential and Power curves.	**08**
Unit -2	
Statistical Methods: Introduction-Collection and classification of data-Graphical Representation – Comparison of frequency distributions- Measures of central tendency-Measures of dispersion- Coefficient of variation	**10**
Unit – 3	
Probability and Distributions: Probability-Condition probability and Baye's theorem- Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance-Binomial, Poisson, Uniform and Normal distributions	**10**
Unit – 4	
Sampling theory Introduction-Population and samples-Sampling distribution of means and Variance (definition only)-Central limit theorem (without proof).	**10**
Unit – 5	
Test of Hypothesis: Introduction-Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of Significance-One tail and two tail tests-Tests concerning one mean and two means (Large and Small samples) z-test, t-distribution, Goodness of fit Test - Tests on proportions: z-test and t-test.	**10**

Text Books/ Reference Books:	
T1	Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.
T2	. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand &Sons Publications, 2012.
T3	B.V.Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006.
R1	Shron L.Myers, Keying Ye, Ronald E Walpole, Probability and Statistics for Engineers and the Scientists,8th edition, Pearson 2007.
R2	Jay L Devore, Probability and Statistics for Engineering and the Sciences, 8thEdition, Cengage.
R3	Sheldon M.Ross, Introduction to probability and statistics Engineers and Scientists,4thEdition, Academic Foundation, 2011.

R4	Johannes Ledolter and Robert V.Hogg, Applied Staistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.
R5	Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press.

Course outcomes: On completion of this course, students are able to	
CO1	Apply least squares method to fit a curve (L5)
CO2	Analysis the data and evaluate the central tendency of data.
CO3	Apply the Concepts of Probability and Find the statistical Parameters of Discrete and Continuous distributions (L3)
CO4	Estimate the properties of population from samples (L5)
CO5	Design the Components of classical Hypothesis test, Conclude the statistical inferential methods based on small and large samples (L6)

ANALOG AND DIGITAL ELECTRONICS			
Subject Code	21CSECT3020	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable the students to:

- Introduce components such as diodes, BJTs and FETs and know the applications
- Understand of various types of amplifier circuits
- Learn basic fundamentals for the simplifications and design of digital circuits.
- Understand the concepts of Combinational and Sequential logic circuits

Unit -1	**Hours**
Diodes and Applications: Semi-conductors, Intrinsic and extrinsic semiconductors, Open circuited p-n junction, Biased p-n junction, p-n junction diode,V-I characteristics, effect of temperature, diode resistance, diffusion capacitance, diode switching times, p-n junction diode as a rectifier, Zener diode, photo diode, LED. Diode Applications - Half wave rectifier, Full wave rectifier, rectifiers with capacitor filter.	**11**
Unit -2	
Bipolar Junction transistors: Transistor characteristics: The junction transistor,transistor current components, CB, CE, CC configurations, comparison of transistor configurations, the operating point, self-bias or Emitter bias, bias compensation, thermal runaway and stability, transistor at low frequencies, transistor as an amplifier, CE amplifier response, gain bandwidth product, Emitter follower, RC coupled amplifier	**11**
Unit – 3	
Field Effect Transistors: FETs: Construction of JFET, V-I characteristics, MOSFET-Basic construction, NMOS, PMOS and CMOS Inverter. **Digital Circuits:** Number systems, 2's and 1's complements, Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates.	**9**
Unit – 4	
Combinational Logic Circuits: The Map Method, Don't-Care Conditions, Binary Adder-Subtractor, Decimal Adder, Magnitude Comparator, Decoders, Encoders, Multiplexers.	**10**
Unit – 5	
Sequential Logic Design: Operation of NAND & NOR Latches and flip-flops; Conversion of flip- flops. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - shift register, universal shift, register.	**9**

Text Books / Reference Books	
T1	A.S. Sedra&K.C.Smith, Microelectronics Circuits, Oxford University Press, 3rd edition, 1997.
T2	Morris Mano, Michael D Ciletti , "Digital Design" , 4thEdition, PEA
T3	R.P. Jain, "Modern Digital Electronics", Tata McGraw-Hill, 4th edition, 2008.
R1	M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons
R2	J.F. Wakerly, "Digital Design Principles", 4th edition, Pearson Education, 2005

Course outcomes: On completion of the course student will be able to:	
CO1	Understand the characteristics and utilization of various components.
CO2	Understand and analyze the BJT and MOSFET
CO3	Apply the Boolean algebra to optimize the logic functions using K-maps and Understand the field effect transistors
CO4	To design and analyze combinational logic circuits
CO5	To design and analyze sequential logic circuits.

Computer Organization			
Subject Code	21CSCST3030	IA Marks	30
Number of Lecture hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits -3			

Course Objectives:

The course objectives of Computer Organization are to discuss and make student familiar with the

1. Principles and the Implementation of Computer Arithmetic.
2. Operation of CPUs including RTL, ALU, Instruction Cycle and Busses.
3. Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design.
4. Memory System and I/O Organization.
5. Principles of Operation of Multiprocessor Systems and Pipelining.

	Hours
UNIT I : **Computer Arithmetic**: Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating – point Arithmetic operations **Register Transfer language and microinstructions** :Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations	**12**
UNIT II : **Basic Computer Organization and Design:** Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input–Output configuration and program Interrupt.	**10**
Unit-III : **Central Processing Unit:** General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control: conditional Flags and Branching	**10**
UNIT IV : **Control Unit**: Hardwired control unit, Control Memory, Address sequencing, Micro program example, Design of control unit	**08**
UNIT V Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.	**10**

Text Books/ Reference Books:	
T1	Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
T2	Digital Design, 5/e, M. Morris Mano, Michael D Ciletti, PEA
R1	Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
R2	Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
R3	Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006.
W1	https://nptel.ac.in/courses/106/105/106105163/
W2	http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf\

Course Outcomes: By the end of the course, the student will	
CO1	Understand and apply computer arithmetic on binary numbers
CO2	Understand and design basic computer organization
CO3	Design & Develop instruction set for basic computer
CO4	Design & Develop control unit for basic computer
CO5	Exemplify in a better way the I/O and memory organization.

JAVA PROGRAMMING			
Subject Code	21CSCST3040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1:	**Hours**
Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. **Data Types, Variables, and Operators:** Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators,Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -)Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. **Control Statements:** Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator ?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.	**08**
Unit -2:	
Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this. Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor, Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods,Nesting of Methods, Overriding Methods, Attributes Final and Static.	**10**
Unit – 3:	
Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Arrays, Arrays as Vectors. Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations..	**10**
Unit – 4:	
Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java	**10**

SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class. Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.	
Unit – 5:	
String Handling in Java Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods forModifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder. Multithreaded Programming Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of NewThreads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. Applets: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle,paint(), update() and repaint(). Swing: Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScrollPane, Split Pane, JTabbedPane, Dialog Box, Pluggable Look and Feel.	**12**

Text(T) / Reference(R) Books:	
T1	JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
T2	The complete Reference Java, 8th edition, Herbert Schildt, TMH.
T3	Programming in JAVA, 2nd edition, Sachin Malhotra, Saurabh Choudary, Oxford.
R1	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
R2	Murach's Java Programming, Joel Murache
W1	https://nptel.ac.in/courses/106/105/106105191/
W2	https://www.w3schools.com/java/java_data_types.asp

Course Outcomes:	
CO1	Able to realize the concept of Object-Oriented Programming & Java Programming Constructs
CO2	Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration, and various keywords
CO3	Apply the concept of exception handling and Input/ Output operations
CO4	Able to design the applications of Java & Java applet
CO5	Able to Analyze & Design the concept of Event Handling and Swing

DATABASE MANAGEMENT SYSTEMS			
Subject Code	21CSCST3050	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To introduce about database management systems
2. To give a good formal foundation on the relational model of data and usage of Relational Algebra
3. To introduce the concepts of basic SQL as a universal Database language
4. To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
5. To provide an overview of database transactions and concurrency control.

Unit -1: Database system architecture	**Hours**
Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Users , Architecture for DBMS.	**10**
Unit -2 : E-R Models	
The E-R Models, The Relational Model, Introduction to Database Design, Data base Design and ER Diagrams, Entities Attributes, and Entity Sets, Relationship and Relationship Sets, Conceptual Design with the ER Models, The Relational Model Integrity Constraints Over Relations, Key Constraints, Foreign Key Constraints, General Constraints.	**10**
Unit - 3: Relational Algebra	
Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus. The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.	**10**
Unit - 4: Normalization	
Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).	**08**
Unit - 5: Transaction Management	
Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, Uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods, lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management.	**12**

Text(T) / Reference(R) Books:	
T1	Introduction to Database Systems, C J Date, Pearson.
T2	Database Management Systems,3rd Edition,Raghurama Krishnan, Johannes Gehrke, TATA Mc Graw Hill.
T3	Database Systems-The Complete Book, H G Molina, J D Ullman, J Widom Pearson.
T4	Database Management Systems,6/e Ramez Elmasri, Shamkant B. Navathe, PEA
R1	DatabaseSystems design, Implementation, and Management,7thEdition,PeterRob&CarlosCoronel
R2	Database System Concepts, 5th edition, Silberschatz, Korth, TMH
R3	The Database Book Principles & Practice Using Oracle/MySQL, Narain Gehani, University Press.
W1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W2	https://www.coursera.org/courses?query=database

Course Outcomes:	
CO1	Recognize the basic elements of a relational database management system.
CO2	Draw entity relationship and convert entity relationship diagrams into RDBMS.
CO3	Create, maintain, and manipulate a relational database using SQL.
CO4	Designs and applies normalization techniques for logical schema model.
CO5	Solves concurrent issues and problems through locking mechanism.

ANALOG AND DIGITAL ELECTRONICS LAB SEMESTER III			
Subject Code	21CSECL4060	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to

- Introduce components such as diodes, BJTs and FETs and know the applications
- Understand of various types of amplifier circuits
- Learn basic fundamentals for the simplifications and design of digital circuits.
- Understand the concepts of Combinational and Sequential logic circuits

List of Experiments:

1. PN junction diode characteristics.
2. Zener Diode Characteristics.
3. Half wave rectifier with and without filter
4. Full wave rectifier with and without filter
5. Common emitter configuration
6. Common source configuration
7. Verify the truth tables of Logic gates
8. Verify the NAND and NOR gates as Universal logic gates
9. Construct and verify the truth tables of Half and Full adders
10. Verify the truth tables of Multiplexer and De-multiplexer
11. Design and implementation of Encoder and Decoder using logic gates
12. Construct 4-bit Synchronous UP/DOWN counter
13. Construct of 4-bit Shift register

Course outcomes:

On completion of the course student will be able to

1. Understand the characteristics of PN Diode and Zener diode
2. Analyze the characteristics of BJT
3. Analyze the characteristics of MOSFET
4. Construct and demonstrate the functionality of Combinational circuits
5. Construct and demonstrate the functionality of Sequential circuits

Course outcomes: On completion of the course student will be able to:	
CO1	Understand the characteristics of PN Diode and Zener diode
CO2	Analyze the characteristics of BJT
CO3	Analyze the characteristics of MOSFET
CO4	Construct and demonstrate the functionality of Combinational circuits
CO5	Construct and demonstrate the functionality of Sequential circuits

JAVA PROGRAMMING LAB			
Subject Code	21CSCSL3070	Internal Marks	15
Number of Tutorial Hours/Week	03(P)	External Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives: This course will enable the students to:

- Evaluate default value of all primitive data type, Operations, Expressions, Control flow, Strings.
- Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism,User defined Exception handling mechanism.
- Illustrating simple inheritance,multi-level inheritance,Exception handling mechanism.
- Construct Threads, Event Handling, implement packages
- Construct applications using applets.

Exercise - 1 (Basics)

a) Write a JAVA program to display default value of all primitive data type of JAVA
b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.
c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
c) Write a JAVA program to sort for an element in a given list of elements using merge sort.
d) Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3 (Class, Objects)

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
b) Write a JAVA program to implement constructor.

Exercise - 4 (Methods)

a) Write a JAVA program to implement constructor overloading.
b) Write a JAVA program implements method overloading.

Exercise - 5 (Inheritance)

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi-level Inheritance
c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

Exercise - 7 (Exception)

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

a) Write a JAVA program that implements Runtime polymorphism
b) Write a Case study on run time polymorphism, inheritance that implements in above problem

Exercise – 9 (User defined Exception)

a) Write a JAVA program for creation of Illustrating throw
b) Write a JAVA program for creation of Illustrating finally
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b) Write a program illustrating **isAlive**and **join ()**
c) Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

a) Write a JAVA program Producer Consumer Problem
b) Write a case study on thread Synchronization after solving the above producer consumer problem

Exercise – 12 (Packages)

a) Write a JAVA program illustrates class path
b) Write a case study on including in class path in your os environment of your package.
c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

a Write a JAVA program to paint like paint brush in applet.
b Write a JAVA program to display analog clock using Applet.
c Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.

Course Outcomes:	
CO1	Evaluate default value of all primitive data type, Operations, Expressions, Control flow, Strings.

CO2	Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism,User defined Exception handling mechanism.
CO3	Illustrating simple inheritance,multi-level inheritance,Exception handling mechanism.
CO4	Construct Threads, Event Handling, implement packages
CO5	Construct applications using applets.

DATABASE MANAGEMENT SYSTEMS LAB			
Subject Code	21CSCSL3080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03

Credits – 1.5

List of Experiments

SQL

Exercise1

Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.

Exercise2

Queries using operators in SQL

Exercise3

Queries to Retrieve and Change Data: Select, Insert, Delete, and Update

Exercise4

Queries using Group By, Order By, and Having Clauses

Exercise5

Queries on Controlling Data: Commit, Rollback, and Save point

Exercise6

Queries for Creating, Dropping, and Altering Tables, Views, and Constraints

Exercise7

Queries on Joins and Correlated Sub-Queries

Exercise 8

Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features

PL/SQL

Exercise 9

Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation

Exercise10

Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL

Exercise11

Write a PL/SQL block using SQL and Control Structures in PL/SQL

Exercise12

Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types

Exercise13

Write a PL/SQL Code using Procedures, Functions, and Packages FORMS

Exercise14

Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc.

Course Outcomes:	
CO1	Explore the concepts of SQL built in functions.

CO2	Design and implement a database schema for a given problem-domain, Normalize a database
CO3	Populate and query a database using SQL DML/DDL commands.
CO4	Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
CO5	Practice PL/SQL including stored procedures, stored functions, cursors, packages.

Data Science using Python			
Subject Code	21CSCSS3090	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03

Credits – 2

Course Objectives:

The main objective of the course is to inculcate the basic understanding of Data Science and it's practical implementation using Python.

Course Outcomes:

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

- Perform various operations on numpy arrays.
- Importing data from different file formats using pandas.
- Draw different types of charts using matplotlib.

List of Experiments :

1. Creating a NumPy Array
    a. Basic ndarray
    b. Array of zeros
    c. Array of ones
    d. Random numbers in ndarray
    e. An array of your choice
    f. Imatrix in NumPy
    g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
    a. Dimensions of NumPy array
    b. Shape of NumPy array
    c. Size of NumPy array
    d. Reshaping a NumPy array
    e. Flattening a NumPy array
    f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
    a. Expanding a NumPy array
    b. Squeezing a NumPy array
    c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
    a. Slicing 1-D NumPy arrays
    b. Slicing 2-D NumPy arrays
    c. Slicing 3-D NumPy arrays
    d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays

a. Stacking ndarrays
b. Concatenating ndarrays
c. Broadcasting in Numpy Array

6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()
8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
    a. Feature Scaling
    b. Feature Standardization
    c. Label Encoding
    d. One Hot Encoding
12. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot

Web References:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/

Course Outcomes: Upon successful completion of the course, the student will be able to	
CO1	Perform various operations on numpy arrays.
CO2	Importing data from different file formats using pandas.

CO3	Apply various techniques to extract data from websources.
CO4	Explore various preprocessing techniques to handle Data Sets.
CO5	Draw different types of charts using matplotlib

BIOLOGY FOR ENGINEERS			
Subject Code	21CMBIN3100	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03
Credits – 00			

Unit -1: Introduction	**Hours**
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.	**06**
Unit -2:Classification	
Plant Hierarchy of life forms at phenomenological level- classification based on (a) cellularity - Unicellular or multicellular (b) ultra-structure- prokaryotes or eukaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophy, lithotrophs (d) Ammonia excretion – ammoniotelic, uricotelic, ureotelic (e) Habitats- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E. coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus	**05**
Unit – 3:Genetics & Biomolecules	
Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	**06**
Unit – 4:Enzymes & Proteins	
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme action. - examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. **Proteins**- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	**07**
Unit – 5:Microbiology & Metabolism	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	**06**

Text(T) / Reference(R) Books:	
T1	Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
T2	Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
T3	Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
R1	Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
R2	Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
W1	https://ocw.mit.edu/courses/biological-engineering/
W2	https://onlinecourses.nptel.ac.in/noc16_ge03/preview

Course Outcomes: On completion of this course, students can	
CO1	Describe how biological observations of 18th Century that lead to major discoveries.
CO2	Convey that classification is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
CO3	Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
CO4	Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
CO5	Classify enzymes and distinguish between different mechanisms of enzyme action, To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Department of Computer Science & Engineering

Detailed Syllabus

Semester –IV (II-II)

DISCRETE MATHEMATICS Common to CSE,CST, IT			
Subject Code	21CMMAT4010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

- To analyze natural language arguments by means of symbolic propositional logic.
- To Identify and manipulate basic mathematical objects such as sets, functions, and relations.
- To use of basic theorems in number theory to solve exponential problems.
- To solve recurrence relations by using different methods.
- To Apply graph theory concepts to solve real-time problems.

Unit -1	**Hours**
Mathematical Logic (TB1: Page Number1 to 72) **Propositional Calculus:** Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, and Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, and Normal Forms. Theory of Inference for Statement Calculus, Consistency of Premises and Indirect Method of Proof. **Predicate Calculus (TB1: Page Number 79 to 99):** Predicates, Predicate Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.	**10**
Unit -2	
Set Theory: **Sets (TB1: Page Number 104 to 123):** Operations on Sets, Principle of Inclusion-Exclusion, **Relations (TB2: Page Number 449 to 473):** Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, **Functions (TB1: Page Number 192 to 232):** Bijective, Composition, Inverse, Permutation, and Recursive Functions**.**	**10**
Unit – 3	
Combinatorics and Number Theory . **Number Theory (TB2: Page Number 237 to 272):** Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems(Proofs not required). **Combinatorics (TB2: Page Number 385 to 431):** Basics of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations.	**10**
Unit – 4	
Recurrence Relations (RB1: Page Number 237 to 305): Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, and Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots.	**08**
Unit – 5	
Graph Theory (TB2: Page Number 641 to 735)	**10**

Introduction to Graphs, Sub graphs, Graph Representations, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs.	

Text(T) / Reference(R) Books:	
T1	Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and R. Manohar, Tata McGraw Hill.
T2	Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
R1	Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
R2	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
R3	Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rdEdition, Tata McGraw Hill.
W1	https://nptel.ac.in/courses/106/106/106106094/

Course outcomes: At the end of the course student will be able to	
CO1	Analyze natural language arguments by means of symbolic propositional logic.
CO2	Identify and manipulate basic mathematical objects such as sets, functions, and relations.
CO3	Use of basic theorems in number theory to solve exponential problems.
CO4	Solve recurrence relations by using different methods.
CO5	Apply graph theory concepts to solve real-time problems.

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT			
Subject Code	21CMMST4020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course objectives:

- To understand the concept and nature of Managerial Economics and Concept of Demand and Demand forecasting.
- To understand the concept of Production function, Input Output relationship, Cost Conceptsand Concept of Cost-Volume-Profit Analysis.
- To understand the Market structures, significance of various pricing methods and different forms of Business organization and the concepts of Business Cycles.
- To understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation
- To understand the concept of Capital, Capitalization, CapitalBudgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods.

Unit -I: Introduction to Managerial Economics and demand Analysis	**Hours**
Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concepts of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement-Demand forecasting and its Methods.	**10**
Unit -II: Production and Cost Analysis	
Production function- Law of Variable proportions- Isoquants and Isocost-Cobb-Douglas Production function-Economics of Scale-Cost Concepts-Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	**10**
Unit-III: Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles	
Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price, Output Determination – Methods of Pricing: Strategies of Pricing & process for selecting final price-. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles –Phases of Business Cycle	**10**
Unit –IV: Introduction to Accounting & Financing Analysis	
Introduction to Double Entry Systems – Journal entry-Ledger-Trail Balance-Final Accounts-Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis.	**10**
Unit-V: Capital and Capital Budgeting	
Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	**10**

Text(T) / Reference(R) Books:	
T1	Managerial Economics and Financial Analysis, Dr. A. R. Aryasri, TMH 2011.
T2	Managerial Economics and Financial Analysis, 1/e,B.Kuberadu, HPH, 2013
T3	Management Science, Dr. P. Vijaya Kumar & Dr. N. Apparao, Cengage, Delhi,2012
T4	Management Science, Dr. A. R. Arya Sri,TNH, 2011.
R1	Financial Accounting for Management, AmbrishGupta,Pearson Education, NewDelhi.
R2	Managerial Economics, 4th Ed, H. Craig Peterson & W. CrisLewis,PHI.
R3	Essentials of management, Koontz and weihrich, TMH 2011
R4	Global management systems, Seth& Rastogi, Cengage learning,delhi,2011
R5	Managerial Economics, V. Maheswari, Sultan Chand
R6	Managerial Economics & Financial Analysis, Dr. B. Kuberudu and Dr. T. V.Ramana, Himalaya Publishing House 2011.
W1	https://www.coursera.org/courses?query=financial%20management
W2	https://www.edx.org/learn/economics

Course Outcomes:	
CO1	Express knowledgeofmanagerialeconomicsandestimatingdemand for a product.
CO2	Recognize ProductionandCostconcepts,estimatingCostBreakeven Analysis.
CO3	ExpressknowledgeonMarketsandPricingmethodsalongwithBusiness Cycles.
CO4	Apply Accounting Concepts and Prepare Financial Statements- and Analysis
CO5	Analyzevariousinvestmentprojectproposalswiththehelpof Capital Budgeting techniques.

OPERATING SYSTEMS			
Subject Code	21CSCST4030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

Introduce the basic concepts of operating systems, its functions and services.

To provide the basic concepts of process management and synchronization.

Familiarize with deadlock issues.

Understand the various memory management skills.

Give exposure over I/O systems and mass storage structures.

Unit -1: Operating Systems Overview	**Hours**
Computer system organization, Operating system structure, Process, memory, storage management, Protection and security, Distributed systems, Computing Environments, Open-source operating systems, OS services, User operating-system interface.	**10**
Unit -2 :System Calls & IPC	
System calls, Types, System programs, OS structure, OS generation, System Boot Process concept, scheduling (Operations on processes, Cooperating processes, Inter-process communication), Multi-threading models	**10**
Unit – 3: Process Management	
Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling, Multiple processor scheduling Operating system, Algorithm Evaluation, The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical regions, Monitors.	**10**
Unit – 4:Memory Management & Dead lock	
System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock. Storage Management: Swapping, Contiguous memory allocation, Paging, Segmentation Virtual Memory Background, Demand paging, copy on write, Page replacement and various Page replacement algorithms, Allocation of frames, Thrashing.	**10**
Unit – 5:I/O Systems	
File concept, Access methods, Directory structure, File system mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap-space management, Protection.	**10**

Text(T) / Reference(R) Books:	
T1	Operating System Concepts Essentials, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons Inc., 2010.
T2	Operating System Concepts, 9th Edition, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley and Sons Inc., 2012
T3	Operating Systems, Second Edition, S Halder, Alex A Aravind, Pearson Education, 2016
T4	Operating Systems – Internals and Design Principles, 7th Edition, William Stallings, Prentice Hall, 2011
R1	Modern Operating Systems, Second Edition, Andrew S. Tanenbaum, Addison Wesley, 2001.
R2	Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education, 1996.
R3	Operating Systems: A Concept-based Approach, Second Edition, D M Dhamdhere, Tata McGraw-Hill Education, 2007
R4	Operating Systems: Internals and Design Principles, Seventh Edition, William Stallings, Prentice Hall, 2011
W1	https://www.coursera.org/courses?query=operating%20system
W2	https://onlinecourses.nptel.ac.in/noc16_cs10/preview

Course Outcomes:	
CO1	Demonstrate knowledge on Computer System organization and Operating system services.
CO2	Design solutions for process synchronization problems by using System calls and Inter process communication.
CO3	Identify the functionality involved in process management concepts like scheduling and synchronization.
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze services of I/O subsystems and mechanisms of security & protection.

DESIGN AND ANALYSIS OF ALGORITHMS			
Subject Code	21CSCST4040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- To provide an introduction to algorithms and performance analysis of algorithms.
- To introduce different algorithmic approaches for problem solving through numerous problems.

Unit -1:	**Hours**
Introduction: What is an Algorithm, Algorithm Specification-Pseudo code Conventions, Recursive Algorithms, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations, Practical Complexities, Performance Measurement. **Divide and Conquer:** The General Method, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort-Performance Measurement**.**	**08**
Unit -2:	
The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees-Prim's Algorithm, Kruskal's Algorithms, Single Source Shortest Paths..	**10**
Unit – 3:	
Dynamic Programming: The General Method, All Pairs Shortest Paths, Single Source Shortest paths General Weights, Optimal Binary Search Trees, 0/1 Knapsack, The Travelling Sales Person Problem and Reliability Design.	**10**
Unit – 4:	
Backtracking: The General Method, 8-Queens Problem, Sum of Subsets, Graph Coloring, and Hamiltonian Cycles.	**10**
Unit – 5:	
Branch and Bound: The Method-Least cost (LC) Search, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem-LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson.	**12**

Text(T) / Reference(R) Books:	
T1	Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
T2	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press.
R1	Introduction to Algorithms Thomas H. Cormen, PHI Learning.
R2	The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E.Hopcroft, JeffreyD.Ullman.
W1	http://nptel.ac.in/courses/106101060/

Course Outcomes:	
CO1	Demonstrate asymptotic notation and divide and conquer technique.
CO2	Use greedy technique to solve various problems.
CO3	Demonstrate dynamic programming technique to various problems.
CO4	Develop algorithms using backtracking technique.
CO5	Demonstrate branch and bound technique to various problems.

SOFTWARE ENGINEERING			
Subject Code	21CSCST4050	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Software and Software Engineering	**Hours**
The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, software Myths. *Process Models:* A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process. *Requirements Analysis and Specification:* Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.	**08**
Unit -2: Software Design	
Overview of the Design Process, How to Characterize of a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design. *Function-Oriented Software Design:*Overview of SA/SD Methodology, Structured analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object-Oriented design. *User Interface Design:* Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of component-based GUI Development, A User Interface Design Methodology.	**10**
Unit – 3: Coding and Testing	
Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.	**10**
Unit – 4: Software Reliability and Quality Management	
Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model. *Computer Aided Software Engineering:* Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case tools, Towards Second Generation CASE Tool, Architecture of a Case Environment.	**10**
Unit – 5: Software Maintenance & Reuse	
Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management. *Software Reuse:* what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at organization Level.	**12**

Text(T) / Reference(R) Books:	
T1	Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHill International Edition.
T2	Fundamentals of Software Engineering, Third Edition, Rajib Mall, PHI.
T3	Software Engineering, Ian Sommerville, Ninth edition, Pearson education
T4	Software Engineering, Concepts and Practices, Ugrasen Suman, Cengage Learning
R1	Software Engineering A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
R2	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
R3	Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press
R4	Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
R5	Software Engineering concepts, R. Fairley, TMH.
W1	https://www.edx.org/learn/software-engineering
W2	https://www.coursera.org/courses?query=software%20engineering

Course Outcomes:	
CO1	Define and develop a software project from requirement gathering to implementation.
CO2	Obtain knowledge about principles and practices of software engineering
CO3	Focus on the fundamentals of software project
CO4	Focus on modelling a software project
CO5	Obtain knowledge about estimation and maintenance of software systems

OPERATING SYSTEMS LAB			
Subject Code	21CSCSL4060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1

Simulate the following CPU scheduling algorithms

Round Robin

SJF

FCFS

Priority

Exercise2

Loading executable programs into memory and execute system call implementation for read(), write(), open(), and close().

Exercise3

Implement fork(), wait(), exec() and exit() system calls.

Exercise4

Simulate the following file allocation strategies

Sequenced

Indexed and

Linked

Exercise5

Simulate MVT and MFT

Exercise6

Simulate the following File Organization Techniques

Single Level Directory

Two Level

Hierarchical

DAG

Exercise7

Simulate Bankers Algorithm for Deadlock Avoidance

Exercise 8

Simulate Bankers Algorithm for Deadlock Prevention

Exercise9

Simulate the following page replacement algorithms

FIFO

LRU

LFU

Exercise10

Simulate Paging Technique of memory management.

Course Outcomes:	
CO1	Implement CPU scheduling algorithms.
CO2	Describe deadlock avoidance and prevention algorithms.
CO3	Interpret page replacement and memory management algorithms.
CO4	Apply the process management concepts & Techniques.
CO5	Describe the storage management concepts.

DESIGN AND ANALYSIS OF ALGORITHMS LAB			
Subject Code	21CSCSL4070	Internal Marks	15
Number of Tutorial Hours/Week	03(P)	External Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives: This course will enable the students to:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations

LIST OF EXPERIMENTS:

Exercise 1 (Dynamic Programming Technique)

a) Longest common Subsequence
b) Develop Optimal Binary search trees

Exercise 2 (Dynamic Programming Technique)

a) 0/1 Knap Sack Problem ,
b) The Traveling Salesperson Problem.

Exercise 3 (Greedy Methods)

a) Huffman codes
b) Knap Sack Problems

Exercise 4 (Greedy Methods)

a) Tree Vertex Splitting
b) Job Sequencing with Dead Lines

Exercise 5 (Back Tracking Techniques)

a) 8-Queens Problem
b) Sum of Sub sets

Exercise 6 (Back Tracking Techniques)

a) Graph Coloring.
b) Hamiltonian Cycles

Exercise 7 (Back Tracking Techniques)

a) 0/1 Knap Sack Problem

Exercise 8 (Branch and Bound)

a) 0/1 Knap Sack Problem
b) Traveling Sales Person Problem

Exercise 9 (Graph Algorithms)

a) Breadth First Search
b) Depth First Search

Exercise 10 (Graph Algorithms)

a) Kruskal`s Algorithm
b) Prim`s Algorithms

Exercise 11 (Graph Algorithms)

a) Bellman Ford Algorithm
b) Dijkstra`s Algorithm

Exercise 12 (Graph Algorithms)

a) Floyd- Warshall Algorithm.

Course Outcomes:	
CO1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
CO2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
CO5	For a given problem of dynamic-programming an develop the dynamic programming algorithms and analyze it to determine its computational complexity.

SOFTWARE ENGINEERING LAB			
Subject Code	21ITITL4080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1
Do the Requirement Analysis and Prepare SRS
Exercise2
Using COCOMO model estimate effort.
Exercise3
Calculate effort using FP oriented estimation model.
Exercise4
Analyze the Risk related to the project and prepare RMMM plan.
Exercise5
DevelopTime-linechartandprojecttableusingPERTorCPMprojectschedulingmethods.
Exercise6
Draw E-R diagrams, DFD, CFD and structured charts for the project.
Exercise7
Design of Test cases based on requirements and design.
Exercise8
Prepare FTR
Exercise 9
Prepare Version control and change control for software configuration items.
Exercise10
Design Software interface
Exercise11
Mini Project

Course Outcomes: On completion of this course, students can	
CO1	Attain knowledge on preparing SRS document
CO2	Estimate the cost of the project.
CO3	Design ER and DFD Diagrams
CO4	Design the test cases for the user specification.
CO5	Implement various versions of software for customization.

MEAN STACK TECHNOLOGIES (HTML 5, JAVASCRIPT, EXPRESS.JS, NODE.JS AND TYPESCRIPT)			
Subject Code	21CSCSS4090	IA Marks	15
Number of Lecture hours/Week	4	Exam Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Credits -2			

List of Exercises	
1.a	**Course Name:** HTML5 - The Language
	Module Name: Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element
	Include the Metadata element in Homepage.html for providing description as "IEKart's is an online shopping website that sells goods in retail. This company deals with various categories like Electronics, Clothing, Accessories etc.
1.b	**Course Name:** HTML5 - The Language
	Module Name: Sectioning Elements
	Enhance the Homepage.html of IEKart's Shopping Application by adding appropriate sectioning elements.
1.c	**Course Name:** HTML5 - The Language
	Module Name: Paragraph Element, Division and Span Elements, List Element
	Make use of appropriate grouping elements such as list items to "About Us" page of IEKart's Shopping Application
1.d	**Course Name:** HTML5 - The Language
	Module Name: Link Element
	Link "Login", "SignUp" and "Track order" to "Login.html", "SignUp.html" and "Track.html" page respectively. Bookmark each category to its details of IEKart's Shopping application.
1.e	**Course Name:** HTML5 - The Language
	Module Name: Character Entities
	Add the © symbol in the Home page footer of IEKart's Shopping application.
1.f	**Course Name:** HTML5 - The Language
	Module Name: HTML5 Global Attributes
	Add the global attributes such as content editable, spell check, id etc. to enhance the Signup Page functionality of IE Kart's Shopping application.
2.a	**Course Name:** HTML5 - The Language
	Module Name: Creating Table Elements, Table Elements : Colspan/ Rowspan Attributes, border, cell spacing, cell padding attributes
	Enhance the details page of IEKart's Shopping application by adding a table element to display the available mobile/any inventories.
2.b	**Course Name:** HTML5 - The Language
	Module Name: Creating Form Elements, Color and Date Pickers, Select and Datalist Elements
	Using the form elements create Signup page for IEKart's Shopping application.
2.c	**Course Name:** HTML5 - The Language
	Module Name: Input Elements – Attributes
	Enhance Signup page functionality of IEKart's Shopping application by adding attributes to input elements.
2.d	**Course Name:** HTML5 - The Language
	Module Name: Media, Iframe
	Add media content in a frame using audio, video, iframe elements to the Home page

	of IEKart's Shopping application.
3.a	**Course Name:** Javascript
	Module Name: Type of Identifiers
	Write a JavaScript program to find the area of a circle usingradius (var and let-reassign and observe the difference with var and let) and PI (const)
3.b	**Course Name:** Javascript
	Module Name: Primitive and Non Primitive Data Types
	Write JavaScript code to display the movie details such as movie name, starring, language, and ratings. Initialize the variables with values of appropriate types. Use template literals wherever necessary.
3.c	**Course Name:** Javascript
	Module Name: Operators and Types of Operators
	Write JavaScript code to book movie tickets online and calculate the total price, considering the number of tickets and price per ticket as Rs. 150. Also, apply afestive season discount of 10% and calculate the discounted amount.
3.d	**Course Name:** Javascript
	Module Name: Types of Statements, Non - Conditional Statements, Types of Conditional Statements, if Statements, switch Statements
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
3.e	**Course Name:** Javascript
	Module Name: Types of Loops
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.a	**Course Name:** Javascript
	Module Name: Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope inFunctions
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.b	**Course Name:** Javascript
	Module Name: Working With Classes, Creating and Inheriting Classes
	Create an Employee class extending from a base class Person. Hints: (i) Create a class Person with name and age as attributes. (ii) Add a constructor to initialize the values (iii) Create a class Employee extending Person with additional attributes role
4.c	**Course Name:** Javascript
	Module Name: In-built Events and Handlers
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.d	**Course Name:** Javascript
	Module Name: Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser Object Model, Document Object Model
	If a user clicks on the given link, they should see an empty cone, a different heading, and a different message and a different background color. If user clicks again, they

	should see a re-filled cone, a different heading, a different message, and a different back ground color
5.a	**Course Name:** Javascript
	Module Name: Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods
	Create an array of objects having movie details. The object should include the movie name, starring, language, and ratings. Render the details of movies on the page using the array.
5.b	**Course Name:** Javascript
	Module Name: Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API
	Simulate a periodic stock price change and display on the console. Hints: (i) Create a method which returns a random number - use Math.random, floor and other methods to return a rounded value. (ii) Invoke the method for every three seconds and stop When random value is zero.
5.c	**Course Name:** Javascript
	Module Name: Creating Modules, Consuming Modules
	Validate the user by creating a login module. Hints: (i) Create a file login.js with a User class. (ii) Create a validate method with username and password as arguments. (iii) If the username and password are equal it will return "Login Successful" else will return “Login is Failure”.
6.a	**Course Name:** Node.js
	Module Name: How to use Node.js
	Verify how to execute different functions successfully in the Node.js platform.
6.b	**Course Name:** Node.js
	Module Name: Create a web server in Node.js
	Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
6.c	**Course Name:** Node.js
	Module Name: Modular programming in Node.js
	Write a Node.js module to show the workflow of Modularization of Node application.
6.d	**Course Name:** Node.js
	Module Name: Restarting Node Application
	Write a program to show the workflow of restarting a Node application.
6.e	**Course Name:** Node.js
	Module Name: File Operations
	Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node.
7.a	**Course Name:** Express.js
	Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters
	Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.
7.b	**Course Name:** Express.js
	Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares
	In myNotes application: (i) we want to handle POST submissions. (ii)display customized error messages. (iii) perform logging.
7.c	**Course Name:** Express.js

	Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults
	Write a Mongoose schema to connect with MongoDB.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_01303558877548544069 1_shared?collectionId=lex_324078356719 46760000_shared&collectionType=Course
7.d	**Course Name:** Express.js
	Module Name: Models
	Write a program to wrap the Schema into a Model object.
8.a	**Course Name:** Express.js
	Module Name: CRUD Operations
	Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.
8.b	**Course Name:** Express.js
	Module Name: API Development
	In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details based on input notes ID
8.c	**Course Name:** Express.js
	Module Name: Why Session management, Cookies
	Write a program to explain session management using cookies.
8.d	**Course Name:** Express.js
	Module Name: Sessions
	Write a program to explain session management using sessions.
8.e	**Course Name:** Express.js
	Module Name: Why and What Security, Helmet Middleware
	Implement security features in myNotes application
9.a	**Course Name:** Typescript
	Module Name: Basics of TypeScript
	On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium.
9.b	**Course Name:** Typescript
	Module Name: Function
	Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass theselected product object to the next screen.
9.c	**Course Name:** Typescript
	Module Name: Parameter Types and Return Types
	Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.
9.d	**Course Name:** Typescript
	Module Name: Arrow Function
	Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equal to 100.
9.e	**Course Name:** Typescript

	Module Name: Optional and Default Parameters
	Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function should return the name of manfacturer
10.a	**Course Name:** Typescript
	Module Name: Rest Parameter
	Implement business logic for adding multiple Product values into a cart variable which is type of string array.
10.b	**Course Name:** Typescript
	Module Name: Creating an Interface
	Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.
10.c	**Course Name:** Typescript
	Module Name: Duck Typing
	Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logicto populate the Product details.
10.d	**Course Name:** Typescript
	Module Name: Function Types
	Declare an interface with function type and access its value.
11.a	**Course Name:** Typescript
	Module Name: Extending Interfaces
	Declare a productList interface which extends properties from two other declared interfaces like Category,Product as well as implementation to create a variable of this interface type.
11 b	**Course Name:** Typescript
	Module Name: Classes
	Consider the Mobile Cart application, Create objects of the Product class and place them into the productlist array.
11.c	**Course Name:** Typescript
	Module Name: Constructor
	Declare a class named - Product with the below-mentioned declarations: (i) productId as number property (ii) Constructor to initialize this value (iii) getProductId method to return the message "Product id is <<id value>>".
11.d	**Course Name:** Typescript
	Module Name: Access Modifiers
	Create a Product class with 4 properties namelyproductId, productName, productPrice, productCategory with private, public, static, and protectedaccess modifiers and accessing them through Gadget class and its methods.
12.a	**Course Name:** Typescript
	Module Name: Properties and Methods
	Create a Product class with 4 properties namely productId and methodsto setProductId() and getProductId().
12.b	**Course Name:** Typescript
	Module Name: Creating and using Namespaces
	Create a namespace called ProductUtility and place the Product class definition in it.

	Import the Product class inside productlist file and use it.
12.c	**Course Name:** Typescript
	Module Name: Creating and using Modules
	Consider the Mobile Cart application which is designed as part of the functions in a module to calculate the total price of the product using the quantity and price values and assign it to a totalPrice variable.
12.d	**Course Name:** Typescript
	Module Name: What is Generics, What are Type Parameters, Generic Functions, Generic Constraints
	Create a generic array and function to sort numbers as well as string values.

Text(T) / Reference(R) Books:	
T1	Pro Mean Stack Development, 1st Edition, ELadElrom, ApressO'Reilly.
T2	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'ReillyMedia.
R1	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1stEdition, DreamTech.
R2	An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.
W1	https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
W2	https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript)
W3	https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview (Node.js &Express.js)
W4	https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview(Typescript)

Course Outcomes: On completion of this course, students can	
CO1	Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video and CSS Styles.
CO2	Utilize JavaScript for developing interactive HTML web pages and validate form .
CO3	Build a basic web server using Node.js and also working with Node Package Manager(NPM).
CO4	Build a web server usingExpress.js
CO5	Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.

SUGGESTED COURSES MINOR ENGINEERING IN IT

Note:

1. TWO, NPTEL courses of EIGHT week duration covering a total of 4 credits (offered by IT/CST/CSE/AI&ML Departments), Student can register at any time after the completion of II B.Tech. I Sem.
2. Students can pursue suggested MOOC Courses via NPTEL from II B.Tech II Sem and onwards, by prior information to the concern.

Eligibility for Minor in IT:

PART A						
S.No	**Subject Code**	**Subject**	**L-T-P**	**Credits**	**Course available in NPTEL**	**NPTEL Link**
1	21XXCSM4010	Data Structures and Algorithms	4-0-0	4	Data Structures Programming, Data Structures and Algorithms using Python	https://onlinecourses.swayam2.ac.in/cec22_cs10/preview https://onlinecourses.nptel.ac.in/noc22_cs26/preview
2	21XXCSM5010	Operating Systems	4-0-0	4	Operating Systems	https://onlinecourses.swayam2.ac.in/cec21_cs20/preview
3	21XXCSM6010	Database Management Systems	4-0-0	4	Data Base Management System (noc22-cs51)	https://onlinecourses.nptel.ac.in/noc22_cs51/pre view
4	21XXCSM7010	Software Engineering	4-0-0	4	Software Engineering	https://onlinecourses.swayam2.ac.in/cec21_cs21/preview

DATA STRUCTURES AND ALGORITHMS			
Subject Code	21XXCSM4010	IA Marks	30
Number of Lecture Hours/Week	4/week	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits – 4			

Course Objectives: The objective of the course is to

- Introduce the fundamental concept of data structures and abstract data types
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Demonstrate the different data structures implementation

Unit -1:	**Hours**
Data Structures - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. **Searching** - Linear search, Binary search, Fibonacci search. **Sorting**- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.	**08**
Unit -2:	
Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list- Insertion, Deletion.	**10**
Unit – 3:	
Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues- Circular Queues, Deques, Priority Queues, Multiple Queues. **Stacks:** Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.	**10**
Unit – 4:	
Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals.	**10**
Unit – 5:	
Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications-Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra's shortest path	**12**

Text(T) / Reference(R) Books:	
T1	Data Structures Using C. 2nd Edition.Reema Thareja,Oxford.
T2	Data Structures and algorithm analysis in C, 2nded, Mark AllenWeiss.
R1	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
R2	Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon,Cengage.
R3	Data Structures with C, Seymour LipschutzTMH
W1	http://algs4.cs.princeton.edu/home/

Course Outcomes:	
CO1	Use basic data structures such as arrays and linked list.
CO2	Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
CO3	Use various searching and sorting algorithms.
CO4	Develop algorithms to construct Binary Search Trees
CO5	Develop algorithms to construct spanning trees

OPERATING SYSTEMS			
Subject Code	21XXCSM5010	IA Marks	30
Number of Lecture Hours/Week	4/week	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits – 4			

Course Objectives: The objectives of this course is to

- Introduce to the internal operation of modern operating systems
- Define,explain,processesandthreads,mutualexclusion,CPUschedulin g,deadlock, memory management, and file systems
- Understand File Systems in Operating System like UNIX/Linux and Windows
- Understand Input Output Management and use of Device Driver and Secondary Storage (Disk)Mechanism
- Analyze Security and Protection Mechanism in Operating System.

Unit -1:	**Hours**
Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. **System Structures:** Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.	**08**
Unit -2:	
Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. **Multithreaded Programming**: Multithreading models, Thread libraries, Threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. **Inter-process Communication:** Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.	**10**
Unit – 3:	
Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. **Virtual Memory Management:** Introduction,Demand paging, Copy on-write, Page replacement,Frameallocation,Thrashing,Memory-mappedfiles,Kernelmemoryallocation	**10**
Unit – 4:	
Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. **File Systems**: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.	**10**

Unit – 5:	
System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. **System Security:** Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer security classification. **Case Studies:** Linux, Microsoft Windows.	**12**

Text(T) / Reference(R) Books:	
TI	Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley,2013.
T2	Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and Filesystems.)
R1	Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill,2012.
R2	Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education,2009.
R3	Nutt G, Operating Systems, 3rd edition, Pearson Education,2004.

Course Outcomes::After learning, the course the students should be able to:	
CO1	Describe various generations of Operating System and functions of Operating
CO2	Describe the concept of program, process and thread and analyze various CPU
CO3	Solve Inter Process Communication problems using Mathematical Equations by
CO4	Compare various Memory Management Schemes especially paging and
CO5	Outline File Systems in Operating System like UNIX/Linux and Windows

DATABASE MANAGEMENT SYSTEMS			
Subject Code	21XXCSM6010	IA Marks	30
Number of Lecture Hours/Week	4/week	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits – 4			

Course Objectives: This Course will enable students to

- Introduce about database management systems
- Give a good formal foundation on the relational model of data and usage of Relational Algebra
- Populate and query a database using SQL DDL/DMLCommands
- Declare and enforce integrity constraints on adatabase
- Writing Queries using advanced concepts ofSQL
- Programming PL/SQL including procedures, functions, cursors andtriggers
- Introduce the concepts of basic SQL as a universal Databaselanguage
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design throughnormalization

Unit -1:	**Hours**
Introduction: Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.	**08**
Unit -2:	
Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).	**10**
Unit – 3:	
Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, subclasses, super class, inheritance, specialization, generalization using ER Diagrams, operations.	**10**
Unit – 4:	
SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set	**10**
Unit – 5:	
Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).	**12**

Text(T) / Reference(R) Books:	
T1	Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH
T2	Database System Concepts,5/e, Silberschatz, Korth,TMH
T3	Oracle: The Complete Reference by OraclePress
T4	Nilesh Shah, "Database Systems Using Oracle", PHI,2007
T5	Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education,2007
R1	Introduction to Database Systems, 8/e C J Date,PEA.
R2	Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe,PEA
R3	Database Principles Fundamentals of Design Implementation and Management, CorlosCoronel, Steven Morris, Peter Robb, Cengage Learning.
W1	https://nptel.ac.in/courses/106/105/106105175/

Course Outcomes:	
CO1	Describe a relational database and object-orienteddatabase
CO2	Create, maintain and manipulate a relational database usingSQL
CO3	Describe ER model and normalization for databasedesign
CO4	Examine issues in data storage and query processing and can formulate appropriatesolutions
CO5	Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategicadvantage

SOFTWARE ENGINEERING			
Subject Code	21XXCSM7010	IA Marks	30
Number of Lecture Hours/Week	4/week	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits – 4			
Course Objectives: This course is designed to acquire the generic software development skill through various stages of software life cycle and also to ensure the quality of software through software development with various protocol based environment			
Unit -1:			**Hours**
The Nature of Software, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.			**08**
Unit -2:			
Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.			**10**
Unit – 3:			
Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling.			**10**
Unit – 4:			
Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component- Based Development.			**10**
Unit – 5:			
The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation, Elements of Software Qualtiy Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing.			**12**

Text(T) / Reference(R) Books:	
T1	Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill HigherEducation.
T2	Software Engineering, Ian Sommerville, Ninth Edition,Pearson.
R1	Software Engineering, A Precise Approach, PankajJalote, Wiley India,2010.
R2	Software Engineering, Ugrasen Suman,Cengage.
W1	https://nptel.ac.in/courses/106/105/106105182/

Course Outcomes:	
CO1	Ability to transform an Object-Oriented Design into high quality, executablecode
CO2	Skills to design, implement, and execute test cases at the Unit and Integrationlevel
CO3	Compare conventional and agile software methods
CO4	Prepare SRS document, design document, test cases and software configuration management and risk management related document.
CO5	Develop function oriented and object oriented software design using tools like rational rose.

Suggested Courses for Honors Program-IT

Pool -1 (AI & ML)				
S.No	**Subject Code**	**Subject**	**L-T-P**	**Credits**
1.	21CSCSH1XXXX	Mathematics for Machine Learning	4-0-0	4
2.	21CSCSH1XXXX	Text Mining and Time Series Analysis	4-0-0	4
3.	21CSCSH1XXXX	Natural Language Processing	4-0-0	4
4.	21CSCSH1XXXX	Reinforcement Learning	4-0-0	4

Pool -2 (Systems Engineering)				
S.No	**Subject Code**	**Subject**	**L-T-P**	**Credits**
1.	21CSCSH2XXXX	Internet of Things	4-0-0	4
2.	21CSCSH2XXXX	Data Communications and Information Coding Theory	4-0-0	4
3.	21CSCSH2XXXX	Service Oriented Architectures	4-0-0	4
4.	21CSCSH2XXXX	Design of Secure Protocols	4-0-0	4

Pool -3 (Information Security)				
S.No	**Subject Code**	**Subject**	**L-T-P**	**Credits**
1.	21CSCSH3XXXX	Principles of Cyber Security	4-0-0	4
2.	21CSCSH3XXXX	Cloud and IoT Security	4-0-0	4
3.	21CSCSH3XXXX	Web Security	4-0-0	4
4.	21CSCSH3XXXX	Block Chain Architecture Design and Use Cases	4-0-0	4

Pool -4 (Data Science)				
S.No	**Subject Code**	**Subject**	**L-T-P**	**Credits**
1.	21CSCSH4XXXX	Data Visualization	4-0-0	4
2.	21CSCSH4XXXX	Statistical Foundations for Data Science	4-0-0	4
3.	21CSCSH4XXXX	Mining Massive Data Sets	4-0-0	4
4.	21CSCSH4XXXX	Medical Image Data Processing	4-0-0	4

MATHEMATICS FOR MACHINE LEARNING (AI & ML)			
Subject Code	21CSCSH1XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits –4			

Course Objectives:

- The main objectives of this course is to make student understand and apply the basic mathematical concepts that are essential for machine learning algorithms

Unit -1:	**Hours**
Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces	**08**
Unit -2:	
Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations	**10**
Unit – 3:	
Matrix Decompositions: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigendecomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny	**10**
Unit – 4:	
Vector Calculus : Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Back propagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series	**10**
Unit – 5:	
Probability and Distributions: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization	**12**

Text(T) / Reference(R) Books:	
T1	"Mathematics for Machine Learning", Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Cambridge UniversityPress.
T2	The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer2017.
R1	Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.

Course Outcomes:	
CO1	Understand the basic notions of machine learning and of the related basic mathematical tools.
CO2	Comprehend the basic concepts and techniques of convex optimization
CO3	Have a good knowledge of the statistical and computational properties of some well known machine learning algorithms.
CO4	Implement machine learning algorithms on synthetic and real data sets using mathematical concepts like linear algebra, probability and calculus.
CO5	Understand the basic notions of machine learning and of the related basic mathematical tools.

TEXT MINING AND TIME SERIES ANALYSIS (AI & ML)			
Subject Code	21CSCSH1XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs

Credits – 4

Course Objectives:

- This course will cover the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision making, with an emphasis on statistical approaches that can be generally applied to arbitrary text data in any natural language with no or minimum human effort.
- Develop the skills needed to do empirical research in fields operating with time series data sets. The course aims to provide students with techniques and receipts for estimation and assessment of quality of economic models with time series data.

Unit -1:	**Hours**
Introduction to Text Mining: Introduction, Algorithms for Text Mining, Information Extraction from Text: Introduction, Named Entity Recognition, Relation Extraction, Unsupervised Information Extraction. Text Summarization Techniques: Extractive Summarization, Topic Representation Approaches, Influence of Context, Indicator Representation and Machine Learning for Summarization.	**08**
Unit -2:	
Text Clustering Algorithms: Introduction, Feature Selection and Transformation Methods for Text Clustering, Distance-Based Clustering Algorithms, Word and Phrase-based Clustering, Probabilistic Document Clustering and Topic Modelling. Dimensionality Reduction and Topic Modelling: Latent Semantic Indexing, Topic Models and Dimension Reduction.	**10**
Unit – 3:	
Text Classification Algorithms: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-based Classifier, Probabilistic and Naïve Bayes Classifiers, Linear Classifier, Proximity- based Classifier, Meta-Algorithms for Text Classification, Probabilistic Models for Text Mining: Mixture models, Stochastic Processes in Bayesian Nonparametric Models, Graphical Models.	**10**
Unit – 4:	
Characteristics of Time Series: Introduction, Nature of Time Series Data, Time Series Statistical Models, Measures of Dependence: Autocorrelation and Cross-Correlation, Stationary Time Series, Time Series Regression and Exploratory Data Analysis: Classical Regression, Exploratory Data Analysis, Smoothing.	**10**
Unit – 5:	
ARIMA Models: Introduction, Autoregressive Moving Average Models, Difference Equations, Autocorrelation and Partial Autocorrelation, Building ARIMA Models, Multiplicative Seasonal ARIMA Models, Spectral Analysis and Filtering: Cyclical Behaviour and Periodicity, Spectral Density, Periodogram and Discrete Fourier Transform, Nonparametric and Parametric Spectral Estimation, Linear Filters, Dynamic Fourier Analysis and Wavelets.	**12**

Text(T) / Reference(R) Books:	
T1	Charu C. Aggarwal, Chengxing Zhai, "Mining Text Data", Kluver Academic Publishers, Springer, 2012.
T2	Robert H. Shumway and David S. Stoffer, "Time Series Analysis and Its Applications with R Examples", Springer,2016.
T3	Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.
R1	James D. Hamilton, Time Series Analysis, Princeton University Press,2004.
R2	Avishek Pal and PKS Prakash, Practical Time Series Analysis, Birmingham - Mumbai,2017.
R3	Box, G.E.P., G.M. Jenkins and G.C. Reinsel. nTime Series Analysis, Forecasting, and Control, 3rd ed. Englewood Cliffs, NJ: Prentice Hall,1994.
R4	Chan, N.H. Time Series: Applications to Finance. 2002, New York:Wiley.
R5	Fuller, W.A. Introduction to Statistical Time Series, 2nd ed. New York: Wiley,1996.

Course Outcomes:	
CO1	Student will be aware of fundamental concepts of text mining, unsupervised information extraction.
CO2	Student will be aware of text clustering algorithms like feature selection, distance-based clustering and latent semantic indexing.
CO3	Student will be aware of Text classification algorithm and text mining techniques.
CO4	Student should aware of all the characteristics of time series and measures of dependencies.
CO5	Student will be able to understand the ARIMA Models.

NATURAL LANGUAGE PROCESSING (AI & ML)			
Subject Code	21CSCSH1XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

- This course introduces the fundamental concepts and techniques of natural language processing (NLP).
- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing**.**

Unit -1:	**Hours**
Introduction : Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.	**08**
Unit -2:	
Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Back off– Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation - based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.	**10**
Unit – 3:	
Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures	**10**
Unit – 4:	
Semantics And Pragmatics: Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.	**10**
Unit – 5:	
Discourse Analysis And Lexical Resources : Discourse segmentation, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus(BNC).	**12**

Text(T) / Reference(R) Books:

T1	Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
T2	Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, OReilly Media,2009.
R1	Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.
R2	Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher,2015.
R3	Richard M Reese, Natural Language Processing with Java, OReilly Media,2015.
R4	Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010. Edition

Course Outcomes:	
CO1	Demonstrate a given text with basic Languagefeatures
CO2	To design an innovative application using NLP components
CO3	Explain a rule based system to tackle morphology/syntax of alanguage
CO4	To design a tag set to be used for statistical processing for real-timeapplications
CO5	To compare and contrast the use of different statistical approaches for different types of NLP applications.

REINFORCEMENT LEARNING (AI & ML)			
Subject Code	21CSCSH1XXXX	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

By the end of the class students should be able to:

- Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
- Given an application problem (e.g. from computer vision, robotics, etc), decide if it should be formulated as a RL problem; if yes be able to define it formally (in terms of the state space, action space, dynamics and reward model), state what algorithm (from class) is best suited for addressing it and justify your answer.

Unit -1:	**Hours**
Reinforcement Learning Problem: Introduction, Elements of Reinforcement Learning, Limitations and Scope, Tic-Tac-Toe, Multi-arm Bandits: *n*-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit, Associative Search.	**08**
Unit -2:	
Finite Markov Decision Processes: Agent-Environment Interface, Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation, Dynamic Programming: Policy- Evaluation, Improvement, Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.	**10**
Unit – 3:	
Monte Carlo Methods: Monte Carlo- Prediction, Estimation of Action Values, Control, Control without Exploring Start, Temporal- Difference learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning, Games, Afterstates.	**10**
Unit – 4:	
Eligibility Traces: *n*-Step TD Prediction, Forward and Backward View of TD(λ), Equivalences of Forward and Backward Views, saras(λ), Watkin's Q(λ), Off-policy Eligibility Traces using Important Sampling, Variable λ.	**10**
Unit – 5:	
Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting and Learning, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.	**12**

Text(T) / Reference(R) Books:	
T1	Rich S. Sutton, Andrew G. Barto, Reinforcement Learning: An Introduction, Second Edition, MIT Press,2015.
T2	Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone parisi, Reinforcement Learning Algorithms: Analysis and Applications, 1st Edition, Springer,2021.
R1	Phil Winder, Reinforcement Learning: Industrial Applications of Intelligent Agent, 1st Edition, O'Reilly,2020.
R2	Kyriakos G. Vamvoudakis, Yan Wan, Frank, L. Lewis, Derya Cansever, Handbook of Reinforcement Learning and Control, 1st Edition, Springer,2021.
W1	https://onlinecourses.nptel.ac.in/noc22_cs34

Course Outcomes:	
CO1	Learn how to define RL problems like Tic-Tac-Toe, Multi-arm.
CO2	Student will be able to understand the finite Markov decision processes.
CO3	Student will be to Understand Monte Carlo Methods and how it is work with tabular methods to solve classical control problems
CO4	Student should aware of Eligibility Traces and Understand how to find with approximate solutions.
CO5	Explore imitation learning tasks and solutions

INTERNET OF THINGS (Systems Engineering)			
Subject Code	21CSCSH2XXXX	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits –4			

Course Objectives: The main objectives of this course are

- Vision and Introduction to Internet of Things(IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Unit -1:	**Hours**
The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP,Telnet.	**08**
Unit -2:	
Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability	**10**
Unit – 3:	
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.	**10**
Unit – 4:	
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.	**10**
Unit – 5:	
Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing theWorld	**12**

Text(T) / Reference(R) Books:	
T1	Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill HigherEducation

T2	Internet of Things, A.Bahgya and V.Madisetti, UnivesityPress,2015
R1	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley
R2	Getting Started with the Internet of Things, CunoPfister ,Oreilly

Course Outcomes:	
CO1	Explain in a concise manner how the general Internet as well as Internet of Thingswork.
CO2	Understand constraints and opportunities of wireless and mobile networks for Internet ofThings.
CO3	Use basic sensing and measurement and tools to determine the real-time performance of network ofdevices.
CO4	Develop prototype models for various applications using IoTtechnology.
CO5	Explain in a concise manner how the general Internet as well as Internet of Thingswork.

DATA COMMUNICATIONS AND INFORMATION CODING THEORY (Systems Engineering)			
Subject Code	21CSCSH2XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits –4			

Course Objective:

The objective of this course is to introduce the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.

Unit -1:	**Hours**
Overview; Basic Concepts - Entropy and Mutual information; Lossless Source Coding – Source entropy rate; Kraft inequality; Huffman code; Asymptotic equipartition property; Universal coding; Noisy Channel Coding – Channel capacity	**08**
Unit -2:	
Random channel codes; Noisy channel coding theorem for discrete memory-less channels; Typical sequences; Error exponents; Feedback; Continuous and Gaussian channels; Lossy Source Coding - Rate- Distortion functions; Random source codes; Joint source-channel coding and the separation theorem.	**10**
Unit – 3:	
Source coding- Text, Audio and Speech: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm– Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding	**10**
Unit – 4:	
Source coding- Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard	**10**
Unit – 5:	
Error control coding- Block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC Error control coding	**12**

Text(T) / Reference(R) Books:	
T1	Mark Kelbert(Author), Yuri Suhov, Information Theory and Coding by Example, Cambridge University Press,2013
R1	Simon Haykin and Michael Moher, Communication Systems, 5th Edition, Wiley,2010
R2	T.M. & Thomas, J.A. (2006). Elements of information theory. New York:Wiley.
R3	Ad´amek, Foundations of coding, Wiley Interscience, 1991.
R4	T. M. Cover and J. A. Thomas, Elements of information theory, Wiley,1991.

Course Outcomes:	
CO1	Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation amongthem.
CO2	Describe the real life applications based on the fundamentaltheory.
CO3	Calculate entropy, channel capacity, bit error rate, code rate, steady-state probability and so on.
CO4	Implement the encoder and decoder of one block code or convolutional code using any program language
CO5	Understand the basic notions of machine learning and of the related basic mathematical tools.

SERVICE ORIENTED ARCHITECTURES (Systems Engineering)			
Subject Code	21CSCSH2XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To learn technology underlying the service design
- To learn the concepts such as SOAP, Registering and Discovering Services.

Unit -1:	**Hours**
Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles **Architecting Process for Software Applications:** Architectural Considerations, Architecting Process for Software Applications, Level 0: High-Level Architecture, Level 1: Solution Architecture Detailed Design	**08**
Unit -2:	
SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA Service-oriented Architecture and Microservices architecture – Drivers for SOA, Dimensions of SOA, Conceptual Modelof SOA, Standards And Guidelines for SOA, Emergence of MSA **Service-Oriented Architecture:** Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process,Service-oriented Analysis and Design (SOAD) Process	**10**
Unit – 3:	
Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model **Service-Oriented Analysis and Design:** Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process Services	**10**
Unit – 4:	
Microservices Architecture: Trend in SOA – Microservices Architecture (MSA): Services Model for Cloud and Mobile Solutions, API Adoption on the Rise, Challenges and Takeways from SOA Implementations Architecture Trend – Microservices Architecture, Microservices Architecture in Action **Cloud and MSA:**Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions	**10**
Unit – 5:	
Mobile and MSA: Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIary PoC	**12**

Text(T) / Reference(R) Books:	
T1	Shankar Kambhampaty, Service - Oriented Architecture & Microservices Architecture, 3ed: For Enterprise, Cloud, Big Data and Mobile , ISBN:9788126564064,Wiley.
T2	Mark Richards, Microservices vs Service-Oriented Architecture, O'Reilly Media, Inc.,2016.
R1	Thomas Erl, Services-Oriented Architecture: Concepts, Technology and Design, Prentice Hall,2005.
R2	Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Service-Oriented Architecture: An Integration Blueprint, Packt Publisher,2010.

Course Outcomes:	
CO1	Get the foundations and concepts of service based computing
CO2	Advocate the importance and means of technology alignment with business
CO3	Understanding the basic operational model of web services,
CO4	Gain the knowledge of key technologies in the service oriented computing arena
CO5	Apply and practice the learning through a real or illustrative project/case study.

DESIGN OF SECURE PROTOCOLS (Systems Engineering)			
Subject Code	21CSCSH2XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:
The main objective of this course is that to explore various protocols and design of various protocols with deeper security.

Unit -1:	**Hours**
OSI:ISO Layer Protocols: Application Layer Protocols, TCP/IP, HTTP, SHTTP, LDAP, MIME, POP & POP3, RMON, SNTP, SNMP. Presentation Layer Protocols, Light Weight Presentation Protocol Session layer protocols.	**08**
Unit -2:	
RPC protocols, transport layer protocols, ITOT, RDP, RUDP, TALI, TCP/UDP, compressed TCP. Network layer Protocols, routing protocols, border gateway protocol-exterior gateway protocol, internet protocol IPv4, IPv6, Internet Message Control Protocol, IRDP Transport Layer Security, TSL, SSL,DTLS	**10**
Unit – 3:	
Data Link layer Protocol, ARP, In ARP, IPCP, IPv6CP, RARP, SLIP .Wide Area and Network Protocols, ATM protocols, Broadband Protocols, Point to Point Protocols, Other WAN Protocols, security issues.	**10**
Unit – 4:	
Local Area Network and LAN Protocols, ETHERNET Protocols, VLAN protocols, Wireless LAN Protocols, Metropolitan Area Network Protocol, Storage Area Network and SAN	**10**
Unit – 5:	
Protocols, FDMA, WIFI and WIMAX Protocols, security issues. Mobile IP, Mobile Support Protocol for IPv4 and IPv6, Resource Reservation Protocol. Multicasting Protocol, VGMP, IGMP, MSDP .Network Security and Technologies and Protocols, AAA Protocols, Tunneling Protocols, Secured Routing Protocols, GRE- Generic Routing Encapsulation, IPSEC– Security.	**12**

Text(T) / Reference(R) Books:	
T1	Jawin: “Networks Protocols Handbook”, 3rd Edition, Jawin Technologies Inc.,2005.
T2	Bruce Potter and Bob Fleck : “802.11 Security”, 1st Edition, O’Reilly Publications,2002.
R1	Ralph Oppliger :“SSL and TSL: Theory and Practice”, 1st Edition, Arttech House,2009.
R2	Lawrence Harte: “Introduction to CDMA- Network services Technologies and Operations”, 1st Edition, Althos Publishing,2004.
R3	Lawrence Harte: “Introduction to WIMAX”, 1st Edition, Althos Publishing,2005

Course Outcomes:	
CO1	Get the exposure to various protocols.
CO2	Gain knowledge on various secure mechanisms through set of protocols.
CO3	Efficiently design new set of protocols.
CO4	Learn Security issues and overcome means with protocols
CO5	Implementation of Network protocols

PRINCIPLES OF CYBER SECURITY (Information Security)			
Subject Code	21CSCSH3XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

Unit -1:	**Hours**
Introduction to Cyber Security-Cyber security objectives, roles, differences between information security and cyber security, Cyber security principles-confidentiality, integrity, availability, authentication and non repudiation	**08**
Unit -2:	
Information Security within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts **Risks & Vulnerabilities-**Basics of risk management, Operational threat environments, Classes of attacks	**10**
Unit – 3:	
Incident Response-Incident categories, Incident response, Incident recovery, **Operational security protection**-Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management	**10**
Unit – 4:	
Threat Detection and Evaluation Monitoring-Vulnerability management, Security logs and alerts, Monitoring tools and appliances, Analysis-Network traffic analysis, packet capture and analysis	**10**
Unit – 5:	
Introduction to backdoor System and security-Introduction to metasploit, backdoor, demilitarized zone (DMZ), Digital signature, Brief study on Harding of operating system.	**12**

Text(T) / Reference(R) Books:

T1	NASSCOM: Security Analyst Student Hand Book, Dec2015
T2	Information Security Management Principles, Updated Edition, David Alexander, Amanda Finch, David Sutton, BCS publishers, June2013
R1	Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security,2nd Edition, ISACA Publishers, 2019

Course Outcomes:

CO1	Apply cyber security architecture principles.
CO2	Demonstrate the risk management processes and practices.
CO3	Appraise cyber security incidents to apply appropriate response
CO4	Distinguish system and application security threats and vulnerabilities.

CO5	Identify security tools and hardening techniques

CLOUD and IoT SECURITY (Information Security)			
Subject Code	21CSCSH3XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Unit -1:	**Hours**
Introduction: Securing Internet of Things: Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications. Security Architecture in the Internet of Things, Security Requirements in IoT, Insufficient Authentication /Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Vulnerabilities, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Attack, Fault trees.	**08**
Unit -2:	
Cryptographic Fundamentals for IoT: Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols.	**10**
Unit – 3:	
Identity & Access Management Solutions for IoT: Identity lifecycle, authentication credentials, IoT IAM infrastructure, Authorization with Publish / Subscribe schemes and access control.	**10**
Unit – 4:	
Privacy Preservation and Trust Models for IoT: Concerns in data dissemination, Lightweight and robust schemes for Privacy protection, Trust and Trust models for IoT, self-organizing Things, Preventing unauthorized access.	**10**
Unit – 5:	
Cloud Security for IoT: Cloud services and IoT, offerings related to IoT from cloud service providers, Cloud IoT security controls, enterprise IoT cloud security architecture, New directions in cloud enabled IoT computing.	**12**

Text(T) / Reference(R) Books:	
T1	Practical Internet of Things Security (Kindle Edition) by Bria Russell, Drew VanDuren
R1	Securing the Internet of Things, Elsevier
R2	Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations
Course Outcomes:	
CO1	Discuss about Security Requirements in IoTArchitecture
CO2	Explain Random numbergeneration
CO3	Demonstrate Authorization with Publish / Subscribeschemes
CO4	Identify Lightweight and robust schemes for Privacyprotection

CO5	Explain about IoT cloud securityarchitecture

WEB SECURITY (Information Security)			
Subject Code	21CSCSH3XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

- Underlying security principles of the web
- Overview of concrete threats against web applications
- Insights into common attacks and counter measures
- Current best practices for secure web applications

Unit -1:	**Hours**
Introduction-A web security forensic lesson, Web languages, Introduction to different web attacks, Overview of N-tier web applications, Web Servers-Apache, IIS.	**08**
Unit -2:	
Securing the Communication Channel- Understanding the dangers of an insecure communication channel. Practical advice on deploying HTTPS, and dealing with the impact on your application, Insights into the latest evolutions for HTTPS deployments.	**10**
Unit – 3:	
Web Hacking Basics- HTTP & HTTPS URL, Web under the Cover Overview of Java security Reading the HTML source, Applet Security Servlets Security Symmetric and Asymmetric Encryptions, Network security Basics, Firewalls & IDS.	**10**
Unit – 4:	
Securely Handling Untrusted Data-Investigation of injection attacks over time, Understanding the cause behind both server-side and client-side injection attacks, Execution of common injection attacks, and implementation of various defenses.	**10**
Unit – 5:	
Preventing Unauthorized Access-Understanding the interplay between authentication, authorization and session management. Practical ways to secure the authentication process prevent authorization bypasses and harden session management mechanisms, Securing Large Applications, Cyber Graffiti.	**12**

Text(T) / Reference(R) Books:	
T1	Web Hacking: Attacks and Defense, Latest Edition , McClure, Stuart, Saumil Shah, and Shreeraj Shah, Addison Wesley,2003
T2	Professional Java Security, 1.3 Edition, Garms, Jess and Daniel Somerfield, Wrox,2001

Course Outcomes:	
CO1	Demonstrate security concepts, security professional roles, and security resources in the context of systems and security development lifecycle
CO2	Justify applicable laws, legal issues and ethical issues regarding computercrime
CO3	Explain the business need for security, threats, attacks, top ten security vulnerabilities, and secure software development
CO4	Apply information security policies, standards and practices, the information securityblueprint
CO5	Analyze and describe security requirements for typical web applicationscenario

BLOCK CHAIN ARCHITECTURE DESIGN AND USE CASES (Information Security)			
Subject Code	21CSCSH3XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

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

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their ownprojects.

Unit -1:	**Hours**
Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. **Evolution of Blockchain:**Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.	**08**
Unit -2:	
Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, **Coding on blockchain:** smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.	**10**
Unit – 3:	
Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.	**10**
Unit – 4:	
Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, OpenZeppelin Contracts.	**10**
Unit – 5:	

Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application. **Advanced Concepts in Blockchain:** Introduction, InterPlanetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.	**12**

Text(T) / Reference(R) Books:	
T1	Ambadas, Arshad Sarfarz Ariff, Sham "Blockchain for Enterprise Application Developers", Wiley
T2	Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Blockchain" ,O'Reilly
R1	Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc GrawHill.
R2	Blockchain: Blueprint for a New Economy, Melanie Swan,O'Reilly
W1	https://github.com/blockchainedindia/resources

Course Outcomes:	
CO1	Demonstrate the foundation of the Block chain technology and understand the processes inpayment andfunding.
CO2	Identify the risks involved in building Block chainapplications.
CO3	Review of legal implications using smartcontracts.
CO4	Choose the present landscape of Blockchain implementations and Understand Crypto currencymarkets
CO5	Examine how to profit from trading cryptocurrencies.

DATA VISUALIZATION (Data Science)			
Subject Code	21CSCSH4XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:
The main objective of this course is to make it easier to identify patterns, trends and outliers in large data set

Unit -1:	**Hours**
Introduction to Data Visualizations and Perception: Introduction of visual perception, visual representation of data, Gestalt principles, Information overload.	**08**
Unit -2:	
Visual Representations: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.	**10**
Unit – 3:	
Classification of Visualization Systems: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents	**10**
Unit – 4:	
Visualization of Groups: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.	**10**
Unit – 5:	
Visualization of Volumetric Data And Evaluation of Visualizations: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations	**12**

Text(T) / Reference(R) Books:	
T1	Ward, Grinstein, Keim, Interactive Data Visualization: Foundations, Techniques, and Applications
R1	Tamara Munzner,Visualization Analysis & Design ,1st edition,AK Peters VisualizationSeries 2014
R2	Scott Murray,Interactive Data Visualization for the Web ,2nd Edition,2017

Course Outcomes:	
CO1	Identify and recognize visual perception and representation ofdata.
CO2	Illustrate about projections of different views ofobjects.
CO3	Apply various Interaction and visualizationtechniques.
CO4	Analyze various groups forvisualization.
CO5	Evaluate visualizations

STATISTICAL FOUNDATIONS FOR DATA SCIENCE (Data Science)			
Subject Code	21CSCSH4XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:
The course will introduce the fundamental concepts of probability and statistics required for a program in data science

Unit -1:	**Hours**
Basics of Data Science: Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems.	**08**
Unit -2:	
Probability, Statistics and Random Processes: Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White- noise process	**10**
Unit – 3:	
Probabilistic formulations of prediction problems: Plug-in estimators, empirical risk minimization, Linear threshold functions, perceptron algorithm, Risk bounds, Concentration inequalities, Uniform convergence, Rademacher averages; combinatorial dimensions, Convex surrogate losses for classification, Linear regression, Regularization and linear model selection, Feature Selection Methods, Cross Validation methods.	**10**
Unit – 4:	
Game-theoretic formulations of prediction problems, High Dimensional methods, Lasso, Ridge Regression, Dimensionality Reduction, Minimax strategies for log loss, linear loss, and quadratic loss, Universal portfolios, Online convex optimization	**10**
Unit – 5:	
Neural networks: Stochastic gradient methods, Combinatorial dimensions and Rademacher averages, Hardness results for learning, Efficient learning algorithms.	**12**

Text(T) / Reference(R) Books:	
T1	Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA,2010
T2	Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA,2011.
R1	James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R, Springer,2013.
R2	Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer,2009.
W1	https://github.com/blockchainedindia/resources

Course Outcomes:	
CO1	Use the statistical concepts in the field of data science.
CO2	Employ the techniques and methods related to the area of data science in variety of applications.
CO3	Apply logical thinking to understand and solve the problem in context.
CO4	Explore statistical learning methods and their application to modern problems in science, industry, and society.
CO5	Build analytics pipelines for regression problems and classification problems

MINING MASSIVE DATA SETS (Data Science)			
Subject Code	21CSCSH4XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:
The course will discuss data mining and machine learning algorithms for analyzing very large amounts of data. The emphasis will be on MapReduce and Sparkas tools for creating parallel algorithms that can process very large amounts of data.

Unit -1:	**Hours**
Data Mining: Data Mining, Statistical Limits on Data Mining, MapReduce: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce.	**08**
Unit -2:	
Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Distance Measures, Theory of Locality-Senstive Functions, Applications of LSH Hashing.	**10**
Unit – 3:	
Mining Data Streams: Stream Data Model, Sampling Data in Streams, Filtering Streams, Link Analysis: PageRank, Efficient Computational of PageRank, Link Spam, Hubs and Authorities.	**10**
Unit – 4:	
Frequent Itemsets: Market-Based Model, Market Based and Apriori Algorithm, Limited- Pass Algorithms, Clustering: Introduction, Hierarchical Clustering and K-means Algorithm, CURE Algorithm.	**10**
Unit – 5:	
Dimensionality Reduction: Eigenvalues and Eigenvectors, Principal-Component Analysis, CUR Decomposition, Large-Scale Machine Learning: Machine Learning Model, Perceptrons, SVM's, Nearest Neighbors.	**12**

Text(T) / Reference(R) Books:	
T1	Jure Leskovec, Anand Rajaraman, Jeffery D. ULLman, Mining of Massive Datasets, Cambridge University Press, 2014.
T2	Pattern Recognition and Machine Learning. Christopher Bishop. Springer-Verlag New York.2006.
R1	Machine Learning: A Probabilistic Perspective. Kevin Murphy. MIT Press.2012
R2	The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer.2013

Course Outcomes:	
CO1	Discuss research directions in Mining Massive Datasets, such as similarity search, streaming data, clustering, and graphmining.
CO2	Analyze policy, focusing on methods for mining massive datasets and potential policy and management applications, by synthesizing and summarizing the current state of the art, and facilitating discussion by posing questions, preliminary conclusions, and ideas to explore.
CO3	Develop a research project relevant to Mining Massive Datasets and produce a report describing the project's background, methods, results, andconclusions.
CO4	Knowledge of basic computer science principles and skills, at a level sufficient to write a reasonably non-trivial computerprogram.
CO5	Good knowledge of Java and Python will be extremely helpful since most assignments will require the use ofSpark

MEDICAL IMAGE DATA PROCESSING (Data Science)			
Subject Code	21CSCSH4XXXX	IA Marks	30
Number of Lecture Hours/Week	4	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

The course will provide the participants with an up-to-date background in current state-of-the-art in medical imaging and medical image analysis. The aim of the course is to show how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computerscience.

Unit -1:	**Hours**
Introduction: Introduction to Medical Imaging Technology, Systems, and Modalities. Brief History, Importance, Applications, Trends, Challenges. Medical Image Formation Principles: X-Ray physics, X- Ray generation, Attenuation, Scattering, Dose Basic Principles of CT, Reconstruction Methods, Artifacts, CThardware.	**08**
Unit -2:	
Storage and Processing: Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS); Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics; filtering; histogram modeling.	**10**
Unit – 3:	
Visualization: Medical Image Visualization Fundamentals of Visualization, Surface and Volume Rendering/Visualization, Animation, Interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, Spin Physics, NMR Spectroscopy, Imaging Principles and Hardware, Image Artifacts.	**10**
Unit – 4:	
Segmentation And Classification: Medical Image Segmentation, Histogram-Based Methods, Region Growing and Watersheds, Markov Random Field Models, Active Contours, Model-Based Segmentation. Multi-Scale Segmentation, Semi-Automated Methods, Clustering-Based Methods, Classification-Based Methods, Atlas-Guided Approaches, Multi-Model Segmentation. Medical Image Registration Intensity- Based Methods, Cost Functions, Optimization Techniques.	**10**
Unit – 5:	
Nuclear Imaging: PET and SPECT Ultrasound Imaging Methods, Mathematical Principles, Resolution, Noise Effect, 3D Imaging, Positron Emission Tomography, Single Photon Emission Tomography, Ultrasound Imaging, Applications. Medical Image Search and Retrieval Current Technology in Medical Image Search, Content-Based Image Retrieval, New Trends: Ontologies, Applications, Other Applications Of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic SupportSystems.	**12**

Text(T) / Reference(R) Books:	
T1	Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, Cambridge University Press, 2009.
T2	J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis", SPIE Publications,2009.
R1	Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press,2005.
R2	Geoff Dougherty, "DigitalImageProcessing for MedicalApplications", First Edition, Cambridge University Press,2009.
R3	Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition 1, Prentice Hall,2005.
R4	John L. Semmlow, "Biosignal and Medical Image Processing", Second Edition, CRC Press,2008.

Course Outcomes:	
CO1	Student will be able to explain the basic concepts of Medical Imaging Technologies, Systems and Formation Principles.
CO2	Student will be able to analyze the Medical Image Storage and Processing.
CO3	Student will be able to visualize the MRI, NMR and Artifacts.
CO4	Student should expertise the Segmentation and Classification techniques on Medical Image Data.
CO5	Student will be able to analyze the Nuclear Imaging like PET, SPECT and 3DImages.

SITE21 Regulations

COURSE STRUCTURE for B. Tech. (CSE)

Semester I (First year I -I)

S.No	Subject Code	Course	Hours			Credits
			L	T	P	
1	21CMEGT1010	Technical English	3	0	0	3
2	21CMMAT1020	Engineering Mathematics - I	3	0	0	3
3	21CMEET1030	Basic Electrical Engineering	3	0	0	3
4	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	21CSMEL1050	Computer Aided Engineering Graphics	2	0	2	3

6	21CMEGL1060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL1070	Basic Electrical Engineering Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMESN1090	Environmental Science	2	0	0	0
		Total	**16**	**0**	**11**	**19.5**

Semester II (First year I -II)

S. No	**Subject Code**	**Course**	**Hours**			**Credits**
			L	**T**	**P**	
1	21CMMAT2010	Engineering Mathematics - II	3	0	0	3
2	21CSPHT2020	Engineering Physics	3	0	0	3
3	21CMCHT2030	Engineering Chemistry	3	0	0	3
4	21CMCST2040	Python Programming	1	0	4	3
5	21CSCST2050	Data Structures	3	0	0	3
6	21CSPHL2060	Engineering Physics Lab	0	0	3	1.5
7	21CMCHL2070	Engineering Chemistry Lab	0	0	3	1.5
8	21CSCSL2080	Data Structures Lab	0	0	3	1.5
9	21CMMSN2090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
		Total	**16**	**0**	**11**	**19.5**

Semester III (Second year II-I)

S. No	Code	Course Title	Hours			Credits
			L	T	P	
1	21CMMAT3010	Probability Distributions & Statistical Methods	3	0	0	3
2	21CSECT3020	Analog & Digital Electronics	3	0	0	3
3	21CSCST3030	Computer Organization	3	0	0	3
4	21CSCST3040	Java Programming	3	0	0	3
5	21CSCST3050	Data Base Management Systems	3	0	0	3
6	21CSCSL3060	Analog &Digital Electronics Lab	0	0	3	1.5
7	21CSCSL3070	Java Programming Lab	0	0	3	1.5
8	21CSCSL3080	Data Base Management Systems Lab	0	0	3	1.5
9	21CSCSS3090	Data Science Using Python	1	0	2	2
10	21CMBIN3100	Biology for Engineers	2	0	0	0
		Total	**18**	**0**	**11**	**21.5**

Semester IV (Second year II-II)

S.No	Code	Course Title	Hours			Credits
			L	T	P	
1	21CSMAT4010	Discrete Mathematics	3	0	0	3
2	21CMMST4020	Engineering Economics & Financial Management	3	0	0	3
3	21CSCST4030	Operating systems	3	0	0	3
4	21CSCST4040	Design and Analysis of Algorithms	3	0	0	3
5	21CSCST4050	Software Engineering	3	0	0	3
6	21CSCSL4060	Operating systems Lab	0	0	3	1.5
7	21CSCSL4070	Design and Analysis of Algorithms Lab	0	0	3	1.5
8	21CSSCL4080	Software Engineering Lab	0	0	3	1.5
9	21CSCSS4090	MEAN Stack Technologies	1	0	2	2
		Total	**17**	**0**	**9**	**21.5**

Semester V (Third Year III-I)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CSCST5010	Automata Theory& Compiler Design	3	0	0	3
2	PC	21CSCST5020	Computer Networks	3	0	0	3
3	PC	21CSCST5030	Data Warehousing and Mining	3	0	0	3
4	PE-I	21CSCSP504X	Professional Elective -I	3	0	0	3
5	OE-I	21CSXXO505X	Open Elective - I	3	0	0	3
6	PC	21CSCSL5060	Computer Networks lab	0	0	3	1.5
7	PC	21CSCSL5070	Data Mining Lab	0	0	3	1.5
8	SOC	21CMAHS5080	**Skill Oriented Course** Soft Skills & Aptitude Builder - 1	1	0	2	2
9	MC	21CSCSN5090	Intellectual Property Rights	2	0	0	0
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)				0	0	0	1.5
				Total credits			**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Category	Credits
Professional core Courses	12
Professional Elective courses	3
Open Elective Course	3
Skill oriented course	2
Summer Internship	1.5
Total Credits	**21.5**

Professional Elective - I	
Code	**Course Title**
21CSCSP504A	Software Testing
21CSCSP504B	Software Project Management
21CSCSP504C	Software Quality Assurance
21CSCSP504D	Agile Software Development

Semester VI (Third year III-II)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CSCST6010	Machine Learning	3	0	0	3
2	PC	21CSCST6020	Devops	3	0	0	3
3	PC	21CSCST6030	Unified Modelling Language	3	0	0	3
4	PE-I	21CSCSP604X	Professional Elective -II	3	0	0	3
5	OE-II	21CSXXO605X	Open Elective Course	3	0	0	3
6	PC	21CSCSL6060	Devops Lab	0	0	3	1.5
7	PC	21CSCSL6070	Machine Learning Lab	0	0	3	1.5
8	PC	21CSCSL6080	Unified Modelling Language Lab	0	0	3	1.5
9	SOC	21CMAHS6090	**Skill Oriented Course** Soft Skills & Aptitude Builder - 2	1	0	2	2
10	MC	21CSCSN6100	**Mandatory course** Essence of Indian Traditional Knowledge	2	0	0	0
Total credits							**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Category	Credits
Professional core courses	13.5
Professional Elective courses	3
Open Elective Course	3
Skill-oriented course/ soft skill course*	2
Mandatory course (AICTE)	0
Total Credits	**21.5**

Professional Elective - II	
Code	**Course Title**
21CSCSP604A	Data Science
21CSCSP604B	Artificial Intelligence
21CSCSP604C	Cloud Computing
21CSCSP604D	Mining Massive Data Sets

Semester VII (Fourth year IV-I)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PE	21CSCSP701X	Professional Elective -III	3	0	0	3
2	PE	21CSCSP702X	Professional Elective - IV	3	0	0	3
3	PE	21CSCSP703X	Professional Elective - V	3	0	0	3
4	OE-III	21CSXXO704X	Open Elective Course	3	0	0	3
5	OE-IV	21CSXXO705X	Open Elective Course	3	0	0	3
6	HS	21CSMST7060	Management Science	0	0	3	3
7	SOC	21CSCSS7070	**Skill Oriented Course** ETL Spark	1	0	2	2
	Summer Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)			0	0	0	3
						Total credits	**23**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Professional Elective - III	
Code	**Course Title**
21CSCSP701A	Network Protocols
21CSCSP701B	Ad-hoc & Sensor Networks
21CSCSP701C	Mobile Computing
21CSCSP701D	Cyber Security

Professional Elective - IV	
Code	**Course Title**
21CSCSP702A	Mobile Application Development
21CSCSP702B	Social Networks & Semantic Web
21CSCSP702C	Computer Vision
21CSCSP702D	Ethical Hacking

Professional Elective - V	
Code	**Course Title**
21CSCSP703A	Block-Chain Technologies
21CSCSP703B	Cryptography and Network Security
21CSCSP703C	Deep Learning
21CSCSP703D	Neural Networks and Soft Computing

Semester VIII (Fourth year IV-II)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PR	21CSCSR8010	Project	0	0	12	12
Total credits							**12**

AUTOMATATHEORY& COMPILER DESIGN			
Subject Code	21CSCST5010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1: Introduction to Formal Languages, DFA, and NFA			**Hours**
Formal Languages and Regular Expressions: Languages, operations on languages, regular expressions (re), languages associated with (re), operations on (re), Identity rules for (re), Finite Automata: DFA, NFA, Conversion of a regular expression to NFA, NFA to DFA.			**10**
Unit -2: Context Free Grammars & Introduction to Compilers			
Context Free Grammars and parsing: Context free Grammars, Leftmost Derivations, Rightmost Derivations, Parse Trees, Ambiguity Grammars, Phases of compiler, Applications of Finite Automata to lexical analysis.			**10**
Unit – 3: Parsers			
Top-Down Parsing, Recursive Descent Parsers: LL(1)Parsers. Bottom-up Parsers: Shift Reduce Parser, LR Parsers: SLR, CLR, LALR			**10**
Unit – 4: Intermediate Code Generation & Code Optimization			
Intermediate code generation: Three address codes, abstract syntax tree, translation of simple statements, and control flow statements. **Code Optimization:** Issues in the design of code optimization, Principal sources of optimization, optimization of basic blocks, Loop optimization, peephole optimization			**10**
Unit – 5: Code Generation			
Code Generation: Issues in the design of code Generation, Machine Dependent Code Generation, object code forms, Register allocation and assignment, DAG representation of basic Blocks, Generating code from DAGs			**08**

Text(T) / Reference(R) Books:	
T1	A Text Book on Automata Theory, Nasir S.F.B, P.K.Srimani, Cambridge university Press
T2	Introduction to Automata Theory,Formal languages and computation, Shamalendukandar, Pearson
T3	Compilers Principles, techniques and Tools, Aho, Ullman, RaviSethi, PEA
R1	Introduction to theory of computation, 2nd ed, Michelsipser, CENGAGE
R2	Principles of Compiler Design, A.V. Aho. J.D.Ullman;PEA
R3	Theory of Computer Science, Automata languages and computation, 2/e, Mishra, Chandra Shekaran, PHI
R4	Theory of Computation, a problem solving approach, kaviMahesh,Wiley
W1	https://onlinecourses.nptel.ac.in/noc18_cs14/preview

Course Outcomes:	
CO1	Ability to classify machines by their power to recognize languages.
CO2	Design context free grammars for formal languages
CO3	Ability to describe the different types of parsers. i.e. Top-down, Bottom-up parsers, Construction of SLR, CLR and LALR parse table
CO4	Ability to explain code optimization techniques
CO5	Ability to explain code generation techniques to improve the performance of a program in terms of speed &space.

COMPUTER NETWORKS			
Subject Code	21CSCST5020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1: Introduction			**Hours**
Network Topologies, WAN, LAN, MAN. OSI Reference Model, TCP/IP Reference Model, Multiplexing (Frequency Division, Wavelength Division, Synchronous Time Division and Statistical Time Division Multiplexing Techniques), Switching Techniques (Circuit-switching, Datagram, Virtual Circuit Networks).			**10**
Unit -2: The Data Link Layer			
Design Issues, Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection and Correction, Error Correcting Codes, Error Detecting Codes, A Simplex Stop and Wait Protocol for an Error free channel, A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols (A One Bit Sliding Window Protocol-A Protocol Using Go-Back-NA Protocol Using Selective Repeat), Data Link Layer in HDLC: Configuration and transmission modes, frames, control fields.			**10**
Unit – 3: The Medium Access Control Sub layer			
The Channel Allocation Problem, Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols (Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited Contention Protocols, Wireless LAN Protocols).			**10**
Unit – 4: Routing Algorithms			
Routing Algorithms- Shortest-Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast and Distance Vector Routing. Congestion Control Algorithms, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding, IP Addressing, Classless and Class full Addressing, Sub-netting.			**10**
Unit – 5: Application Layer			
Application Layer: The Domain Name System- The DNS Name Space, Resource Records, Name Servers, Electronic Mail Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery.			08

Text(T) / Reference(R) Books:	
T1	Computer Networks, 5th Edition, Tanenbaum and David J Wetherall, Pearson Edu, 2010.
T2	Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education.
R1	Computer Networks, Mayank Dave, CENGAGE
R2	Data and Computer Communications, Fifth Edition, William Stallings, PHI, 2005.
R3	Computer Networks, A Systems Approach, Fifth Edition, Peterson & Davie, Harcourt, 2011.
R4	Network Management Standards, Second Edition, Ulysses Black, McGraw Hill, 1994
W1	https://swayam.gov.in/courses/5172-computer-networks
W2	https://www.coursera.org/courses?query=computer%20network

Course Outcomes:	
CO1	Illustrate the concept of network reference models and classification of multiplexing.
CO2	Explain the design issues and various protocols of data link layer.
CO3	Interpret the use of medium access control sub layer.
CO4	Analyze various routing algorithms.
CO5	Experiment with congestion control algorithms and to illustrate the concept of domain name system.

DATA WAREHOUSING & MINING			
Subject Code	21CSCST5030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Data Warehousing and Business Analysis: - Data warehousing OLAP & OLTP Components –Building a Data warehouse –Data Warehouse Architecture. Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.	**10**
Unit -2: Data Pre-processing	
Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	**10**
Unit – 3: Classification	
Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction. Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks	**10**
Unit – 4: Association Analysis	
Problem Defecation, Frequent Item Set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithm.	**10**
Unit – 5: Cluster Analysis	
What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Centre-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses.	**08**

Text(T) / Reference(R) Books:	
T1	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
T2	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier
R1	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
R2	Data Mining: Vikram Pudi and P. Radha Krishna, Oxford.

R3	Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
R4	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
R5	Data Mining: Introductory and Advanced Topics: Dunham, Pearson.
W1	https://www.edx.org/learn/data-mining
W2	https://www.coursera.org/specializations/data-mining
W3	https://www.coursera.org/courses?query=data%20warehouse

Course Outcomes: On completion of this course, students can	
CO1	Understand stages in building a Data Warehouse
CO2	Understand the need and importance of pre-processing techniques
CO3	Understand the need and importance of Similarity and dissimilarity techniques
CO4	Analyze and evaluate performance of algorithms for Association Rules.
CO5	Analyze Classification and Clustering algorithms

SOFTWARE TESTING (PROFESSIONAL ELECTIVE-I)			
Subject Code	21CSCSP504A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1			**Hours**
Introduction: Purpose of Testing, Dichotomies, Model for Testing, Levels of Testing, Basic definitions, Software Testing Principles, The Tester‘s Role in Software Development, Consequences of Bugs, Taxonomy of Bugs. **Flow graphs and Path testing:** Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Applications of Path Testing.			**10**
Unit -2			
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. **Dataflow testing:** Basics of Data flow Testing, Strategies in Data flow Testing, Application of Data flow Testing			**08**
Unit – 3			
Paths and Regular expressions: Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. **Syntax Testing:** Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips			**10**
Unit – 4			
Logic Based Testing: Overview, Decision Tables, KV Charts, and Specifications **State, State Graphs and Transition Testing:** State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips. **Graph Matrices and Application: -** Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.			**10**
Unit – 5			
Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, skills needed for automation, scope of automation, challenges in automation, Introduction to testing tools like Win runner, Load Runner, Selenium and working with selenium			**08**

Text(T) / Reference(R) Books:	
T1	"Software testing techniques"–BorisBeizer, Dreamtech, second edition.
T2	"Software Testing"- Yogesh Singh, Camebridge
R1	"The Craft of software testing" - Brian Marick, Pearson Education.
R2	"Software Testing", N.Chauhan, Oxford University Press.
R3	"Introduction to Software Testing", P.Ammann &J.Offutt, Cambridge Univ.Press.
R4	"Effective methods of Software Testing", Perry, John Wiley, 2nd Edition, 1999.
R5	"Foundations of Software Testing", D.Graham, CengageLearning
W1	https://www.coursera.org/courses?query=software%20testing
W2	https://www.edx.org/course/software-testing-fundamentals-usmx-umuc-stv1-1x-4

Course Outcomes:	
CO1	Discuss basic software testing terminology, concepts of path testing and applications.
CO2	Discuss Data flow testing and transaction flow testing methods
CO3	Implement and generate test cases in syntax testing
CO4	Develop test cases and test suites by using different testing methods
CO5	Analyze the applications manually by applying different testing methods in state graphs and transition testing

SOFTWARE PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE - I)			
Subject Code	21CSCSP504B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Project, Management, Software Project Management activities, Challenges in software projects, stake holders, objectives & goals. Project Planning: Step-wise planning, Project scope, Project products & deliverables, Project activities, Effort estimation, Infrastructure. Project Approach: Life cycle models, choosing technology, prototyping, life cycle phases, process artefacts, process work flows.	**10**
Unit -2: Effort estimation & Activity Planning	
Estimation techniques, Function point analysis, SLOC, COCOMO, Usecase-based estimation, Activity identification approaches, network planning models, critical path analysis.	**10**
Unit – 3: Risk management	
Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach.	**10**
Unit – 4: Project Management and Control	
Creating framework for monitoring and control, progress monitoring, Cost monitoring, Earned value analysis, defects tracking, issues tracking, status reports, Types of resources, Identifying resource requirements, Resource scheduling.	**10**
Unit – 5: Software Quality	
Planning quality, defining quality – ISO 9016, Quality measures, quantitative quality management planning, product quality & process quality metrics, statistical process control capability maturity model, enhancing software quality.	**08**

Text(T) / Reference(R) Books:	
T1	Software Project Management, Bob Hughes & Mike Cotterell, TATA McGraw-Hill
T2	Software Project Management, Walker Royce: Pearson Education, 2005
T3	Software Project Management in practice, Pankaj Jalote, Pearson
R1	Software Project Management, Joel Henry, Pearson Education

Course Outcomes:	
CO1	To match organizational needs to the most effective software development model
CO2	To describe basic concepts and issues of software project management
CO3	To effectively plan and implement the projects through managing people
CO4	To effectively plan and implement the projects through communication and change.
CO5	To select and employ mechanisms for tracking the software projects

SOFTWARE QUALITY ASSURANCE (PROFESSIONAL ELECTIVE – I)			
Subject Code	21CSCSP504C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	**Hours**
The Role of SQA, SQA Plan, SQA considerations, SQA people, Quality, Management, Software Configuration Management.	**10**
Unit -2: MANAGING SOFTWARE QUALITY	
Managing Software Organizations, Managing Software Quality, Defect Prevention, Software Quality Assurance Management.	**10**
Unit – 3: SOFTWARE QUALITY ASSURANCE METRICS	
Software Quality, Total Quality Management (TQM), Quality Metrics, Software Quality Metrics Analysis.	**08**
Unit – 4: SOFTWARE QUALITY PROGRAM	
Software Quality Program Concepts, Establishment of a Software Quality Program, Software Quality Assurance Planning, An Overview, Purpose & Scope.	**10**
Unit – 5: SOFTWARE QUALITY ASSURANCE STANDARDIZATION	
Software Standards–ISO 9000 Quality System Standards, Capability Maturity Model and the Role of SQA in Software Development Maturity, SEI CMM Level 5, Comparison of ISO 9000 Model with SEI's CMM.	**10**

Text(T) / Reference(R) Books:	
T1	Software Quality, Mordechai Ben-Menachem / Garry S Marliss, Vikas Publishing House, Pvt, Ltd., New Delhi.
T2	Managing the Software Process, Watts S Humphrey, Pearson Education Inc.
R1	Handbook of Software Quality Assurance, Gordon G Schulmeyer, Third Edition, Artech House Publishers 2007
R2	Software Quality Assurance: Principles and Practice, Nina S Godbole, Alpha Science International, Ltd, 2004
W1	https://www.udemy.com/software-quality-assurance/
W2	https://www.coursera.org/courses?query=quality%20assurance

Course Outcomes: On completion of this course, students can	
CO1	To learn Software quality factors
CO2	To learn Common software testing methodologies
CO3	To learn about project process control
CO4	To learn about software metrics and standardizations

CO5	To learn about certifications

AGILE SOFTWARE DEVELOPMENT (PROFESSIONAL ELECTIVE-I)			
Subject Code	21CSCSP504D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: INTRODUCTION	**Hours**
Introduction: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility	**10**
Unit -2: PROJECT PLANNING	
Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories–Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations	**10**
Unit – 3: PROJECT DESIGN	
Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.	**10**
Unit – 4: DESIGN METHODOLOGIES	
Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values, and practices. Kanban, Feature-driven development, Lean software development.	**10**
Unit – 5: TESTING	
Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.	**08**

Text(T) / Reference(R) Books:	
T1	Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, International Edition, Pearson.
T2	Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, First International Edition, Prentice Hall.
T3	Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, “Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design”, First edition, Packt Publisher.

R1	Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams, International edition, Addison Wesley.
R2	Alistair Cockburn, “Agile Software Development: The Cooperative Game”, 2nd Edition, Addison-Wesley
W1	“Agile Software Development”, https://www.edx.org/course/agile-software-development Accessed on August 27, 2021.
W2	“Agile Software Development”, https://www.coursera.org/learn/agile-software-development Accessed on August 27, 2021

Course Outcomes:	
CO1	Understand the concept of agile software engineering and its advantages in software development.
CO2	Understand project planning and the structure of agile team.
CO3	Explain the role of design principles in agile software design.
CO4	Define the core practices behind Scrum framework.
CO5	Describe the implications of functional testing, unit testing, and continuous integration.

INTELLECTUAL PROPERTY RIGHTS			
Subject Code	21CSCSN5090	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03
Credits – 00			
Unit -1:			**Hours**
Introduction: Introduction to Intellectual property, types of intellectual property, the importance of intellectual property rights, agencies Responsible for Intellectual property Registration, Regulatory – Compliance and Liability Issues.			06
Unit -2:			
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, Transfer of Rights, protectable matter, selecting and evaluating trade mark, Registrations of Trade Marks, Claims. **Trade Secrets**: Determination of trade secret status, liability for misappropriations of trade secrets, protection for submission,			**06**
Unit – 3:			
Copy rights: Fundamental of copy right, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, notice of copy right. **Patents:** introduction, patent searching process, ownership rights and transfer			**06**
Unit – 4:			
Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.			**06**
Unit – 5:			
New development of Intellectual Property: Emerging trends in trade mark; copy rights, patent, International overview on intellectual property.			**06**

Text(T) / Reference(R) Books:	
T1	Intellectual property right, Deborah, E. Bouchoux, cengage learning.
T2	Cyber Law. Text & Cases, South-Western's Special Topics collections
T3	R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi
R1	A short course in International Intellectual Property Rights – Karla C. Shippey, World Trade Press – 2 nd Edition
R2	Intellectual Property Rights: N K Acharya: ISBN: 9381849309

Course Outcomes:	
CO1	IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents.
CO2	Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property law and policy

Course Outcomes:	
CO3	Student gets an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.
CO4	Students should be able to write reports on project work and critical reflect on their own learning.
CO5	Analyze ethical and professional issues which arise in the intellectual property law context

Computer Networks Lab			
Subject Code	21CSCSL5060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1

Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whoisetc. Usage of elementary socket system calls (socket (), bind(), listen(), accept(),connect(),send(),recv(),sendto(),recvfrom().

Exercise2

Implementation of Connection oriented concurrent service (TCP).

Exercise3

Implementation of Connectionless Iterative time service (UDP).

Exercise4

Implementation of Select system call.

Exercise5

Implementation of gesockopt (), setsockopt () system calls.

Exercise6

Implementation of getpeername () system call.

Exercise7

Implementation of remote command execution using socket system calls.

Exercise8

Implementation of Distance Vector Routing Algorithm.

Exercise9

Implementation of SMTP.

Exercise10

Implementation of FTP.

Exercise11

Implementation of HTTP.

Exercise12

Implementation of RSA algorithm**.**

DATA WAREHOUSING AND DATA MINING LAB			
Subject Code	21CSCSL5070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Note: Use python library scikit-learn wherever necessary

Exercise1

Demonstrate the following data preprocessing tasks using python libraries.

a) Loading the dataset

b) Identifying the dependent and independent variables c) Dealing with missing data

Exercise2

Demonstrate the following data preprocessing tasks using python libraries.

a) Dealing with categorical data

b) Scaling the features

c) Splitting dataset into Training and Testing Sets

Exercise3

Demonstrate the following Similarity and Dissimilarity Measures using python

a) Pearson's Correlation

b) Cosine Similarity

c) Jaccard Similarity

d) Euclidean Distance

e) Manhattan Distance

Exercise4

Build a model using linear regression algorithm on any dataset.

Exercise5

Build a classification model using Decision Tree algorithm on iris dataset

Exercise6

Apply Naïve Bayes Classification algorithm on any dataset

Exercise7

Generate frequent itemset using Apriori Algorithm in python and also generate association rules for any market basket data.

Exercise 8

Apply K- Means clustering algorithm on any dataset.

Exercise9

Apply Hierarchical Clustering algorithm on any dataset.

Exercise10

Apply DBSCAN clustering algorithm on any dataset.

Course Outcomes:	
CO1	Apply preprocessing techniques on real world datasets
CO2	Apply apriori algorithm to generate frequent itemsets.
CO3	Apply Classification algorithms on different datasets.
CO4	Apply Clustering algorithms on different datasets.
CO5	Find dissimilarities in data

Soft Skills & Aptitude Builder - 1			
Subject Code	21CMAHS5080	IA Marks	**15+15**
Number of Lecture Hours/Week	**2**	Exam Marks	**35+35**
Total Number of Lecture Hours	**32**	Exam Hours	**3**
Credits – 2			
Section A, Soft Skills			
Unit – 1: Intrapersonal Communication			**Hours**
Introduction to Soft Skills and its Significance **Personal Effectiveness**: Who am I and What am I; My Strengths and Weaknesses; SWOT Analysis; SMART Goal Setting; Being Proactive **Principles of Personal Vision**: Beginning with the End in Mind; Time Management: Understanding Priorities; Put First-Things-First **Activity**: Psychometric Tests and SWOT Analysis, SMART Goal Setting			**6**
Unit 2: Interpersonal Communication			
Principles of Creative Cooperation and Organisation Skills: Think Win-Win; Seek First to Understand then to be Understood; Synergize; Life-Long Learning **Emotional Intelligence**: Self-Awareness, Self-Regulation, Empathy, Assertiveness, Adoptability, Managing Emotions **Activity**: Resolving a Conflict with your Friend/Colleague/Family Member; Group Discussions & Debates			**6**
Unit – 3: 21st Century Skills			
What are 21st Century Skills? Learning Skills- Digital Literacy- Life Skills **Critical Thinking**: Active Listening, Observation, Introspection, Analytical Thinking, Open Mindedness **Problem Solving**: Understanding the Complexity of the Problem, Defining the Problem, Cause and Effect Analysis, Exploring Possible Solutions, Planning Actions, Analysing Results of your Actions, Getting Feedback, Redefining the Problem, The Problem Solving Cycle **Decision Making**: Managing Conflict, Conflict Resolution, Methods of Decision Making, Effective Decision Making in Teams – Methods & Styles **Activity**: Case Study			**6**
Section B,Aptitude Builder			
Unit – 4: Ratios & Percentages			
Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios, Compound Ratio, Problems on Proportion, Mean Proportional and Continued Proportion. **Partnership:** Introduction, Relation between Capitals, Period of Investments and Shares **Number System:** Classification of Numbers, Divisibility Rules, Finding the Units Digit, Finding Remainders in Divisions Involving Higher Powers, LCM and HCF Models **Percentages:** Introduction, Converting a Percentage into Decimals, Converting a Decimal into Percentage, Percentage Equivalent of Fractions, Problems on Percentages **Profit And Loss:** Problems on Profit and Loss Percentage, Relation between Cost Price and Selling Price, Discount and Marked Price, Two Different			**7**

Articles Sold at Same Cost Price, Two Different Articles Sold at Same Selling Price Gain% / Loss% on Selling Price **Problems on Ages:** Introduction, Problems based on Ages **Averages:** Definition of Average, Rules of Average, Problems on Average , Problems on Weighted Average, Finding Average using Assumed Mean Method **Alligation and Mixture:** Problems on Mixtures, Alligation Rule, Problems on Alligation	
Unit – 5: Mental Ability	
Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters **Number and Letter Analogies:** Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy **Odd Man Out:** Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out **Coding and Decoding:** Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model **Blood relations:** Defining the Various Relations among the Members of a Family, Solving Blood Relation Puzzles, Solving the Problems on Blood Relations using Symbols and Notations **Direction Sense:** Solving Problems by Drawing the Paths, Finding the Net Distance Travelled, Finding the Direction, Problems on Clocks ,Problems on Shadows	**7**

Section-A: Text (T) / Reference (R) Books:	
For Units 1, 2, & 3	
T1	English and Soft Skills, Dr. S. P. Dhanvel, Orient Blackswan, 2011
R1	Seven Habits of Highly Effective People, Stephen R Covey
R2	Emotional Intelligence, Daniel Goleman, Bantom Book, 2006
R3	21st Century Skills: Learning for Life in our Times, Bernie Trilling, Charles Fadel; John Wiley & Sons
For Units 4&5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A Modern Approach to Logical Reasoning'
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's Verbal Reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO1	re-engineer attitude and understand its influence on behaviour
CO 2	develop interpersonal skills and be an effective goal oriented team player
CO 3	develop holistic personality with a mature outlook to function effectively in different circumstances
Section B: Aptitude Builder	
CO 4	solve the real-time problems for performing job functions easily
CO 5	analyse the problems logically and critically

Semester VI (Third year III-II)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CSCST6010	Machine Learning	3	0	0	3
2	PC	21CSCST6020	Devops	3	0	0	3
3	PC	21CSCST6030	Unified Modelling Language	3	0	0	3
4	PE-I	21CSCSP604X	Professional Elective -II	3	0	0	3
5	OE-I	21CSXXO605X	Open Elective Course	3	0	0	3
6	PC	21CSCSL6060	Devops Lab	0	0	3	1.5
7	PC	21CSCSL6070	Machine Learning Lab	0	0	3	1.5
	PC	21CSCSL6080	Unified Modelling Language Lab	0	0	3	1.5
8	SOC	21CSCSS6090	**Skill Oriented Course** Soft Skills & Aptitude Builder - 2	1	0	2	2
9	MC	21CSCSN6100	**Mandatory course** Essence of Indian Traditional Knowledge	2	0	0	0
Total credits							**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Category	Credits
Professional core courses	13.5
Professional Elective courses	3
Open Elective Course	3
Skill-oriented course/ soft skill course*	2
Mandatory course (AICTE)	0
Total Credits	**21.5**

Professional Elective - II	
Code	**Course Title**
21CSCSP604A	Data Science
21CSCSP604B	Artificial Intelligence
21CSCSP604C	Cloud Computing
21CSCSP604D	Mining Massive Datasets

MACHINE LEARNING			
Subject Code	21CSCST6010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
2. The ability to implement some basic machine learning algorithms.
3. Understanding of how machine learning algorithms are evaluated.

Unit -1: Introduction	**Hours**
Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. **Statistical Learning:** Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.	**10**
Unit -2: Supervised Learning (Regression/Classification)	
Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.	**10**
Unit – 3: Ensemble Learning and Random Forests	
Introduction, Voting Classifiers, Bagging and Pasting,Random Forests, Boosting, Stacking. **Support Vector Machine:** Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.	**10**
Unit – 4: Unsupervised Learning Techniques	
Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for SemiSupervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.	**10**
Unit – 5: Neural Networks and Deep Learning	
Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.	**08**

Text(T) / Reference® Books:	
T1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
T2	Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020
R1	Understanding Machine Learning: From Theory to algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge.
R2	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012
W1	https://www.tutorialspoint.com/what-is-machine-learning
W2	https://www.analyticsvidhya.com/machine-learning/
W3	https://www.youtube.com/watch?v=eq7KF7JTinU

Course Outcomes: On completion of this course, students can	
CO1	Explain the fundamental usage of the concept Machine Learning system
CO2	Demonstrate on various regression Technique
CO3	Analyze the Ensemble Learning Methods
CO4	Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
CO5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning

DEVOPS			
Subject Code	21CSCST6020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Introduces the basic concepts of Information System.
2. To understand The Management Control Framework and The Application Control Framework

Unit -1: Introduction	**Hours**
Phases of Software Development Life Cycle, Values and principles of agile software development.	**10**
Unit -2: Fundamentals of DevOps	
Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.	**10**
Unit - 3: DevOps adoption in projects	
Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes	**10**
Unit - 4: CI/CD	
Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices	**10**
Unit - 5: Devops Maturity Model	
Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment	**08**

Text(T) / Reference® Books:	
T1	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
T2	What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.
R1	Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications, 2013

Course Outcomes: On completion of this course, students can	
CO1	Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.
CO2	Describe DevOps & DevSecOps methodologies and their key concepts
CO3	Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
CO4	Set up complete private infrastructure using version control systems and CI/CD tools
CO5	Acquire the knowledge of maturity model, Maturity Assessment

UNIFIED MODELING LANGUAGE			
Subject Code	21CSCST6030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Understand how to solve complex problems and
2. Analyze the problems using the object-oriented approach
3. Design Solutions to the problems using an object-oriented approach
4. Study the notations of the unified modeling language

Unit – 1: Introduction	**Hours**
Introduction to OOAD, Activities/ Workflows / Disciplines in OOAD, Introduction to iterative development and the unified process, Introduction to UML, Mapping Disciplines to UML artefacts, why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.	**10**
Unit – 2: Classes and Objects	
Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.	**10**
Unit – 3: Basic Behavioral Modelling	
Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.	**10**
Unit – 4: Advanced Behavioral Modelling	
Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	**10**
Unit – 5: Architectural Modelling	
Component, Deployment, Component diagrams and Deployment diagrams. *Case Study:* The Unified Library application.	**08**

Text(T) / Reference® Books:	
T1	Object- Oriented Analysis and Design with Applications, Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
T2	The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.
T3	Applying UML and Patterns by Criag Larman, Person
R1	Object-oriented analysis and design using UML, Mahesh P. Matha, PHI.
R2	Head first object-oriented analysis and design, Brett D. McLaughlin, Gary Pollice, Dave West, O‟Reilly.
R3	Object-oriented analysis and design with the Unified process John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning.
R4	The Unified modelling language Reference manual, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley.
W1	https://www.coursera.org/courses?query=uml
W2	https://www.udemy.com/topic/uml/

Course Outcomes: On completion of this course, students can	
CO1	Ability to find solutions to the complex problems using object-oriented approach.
CO2	Represent classes, responsibilities and states using UML notation.
CO3	Identify Classes of problem domain.
CO4	Identify the responsibilities of the problem domain.
CO5	Learn Architectural modelling concepts

DATA SCIENCE			
Subject Code	21CSCSP604A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits–08			

Unit-1: Introduction to Data Science	**Hours**
Introduction to Data Science: Introduction, Terminology, data science process, Types of data classification-data science algorithms (Linear Regression, K-means, support vector machines, ANN, RNN, Appriori), Example Applications	**10**
Unit-2: Data Collection and Management	
Data collection and management: Introduction, Data collection methods, Data Collection and APIs, API Categories, Exploring and fixing data, Data storage and management, Using multiple data sources	**10**
Unit–3: Data Analysis	
Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naïve Bayes.	**10**
Unit–4: Data Visualization	
Data visualization: Introduction, Types of data visualization, Data for visualization: Datatypes, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Introduction to matplotlib.	**10**
Unit–5: Applications and Recent Trends in Data Science	
Applications and recent trends of Data Science: Applications of data science, Technologies for visualization, Bokeh(Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application Development methods of used in data science	**08**

Text(T) /Reference(R)Books:	
T1	Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
T2	Jure Leskovek, Anand Rajaram anand Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press
R1	Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly media, 2015
R2	Matt Harrison, "Learning the Pandas Library: Python Tools for Data Mining, Analysis, and Visualization, O'Reilly,2016

Course Outcomes: After completion of this course, students able to	
CO1	Identify the types of data in Data Science
CO2	Understand how to collect the data, manage the data
CO3	Classify the data using SVM and Navie Bayesian
CO4	Explore visual analysis techniques
CO5	Explore the latest trends in data science techniques.

ARTIFICIAL INTELLIGENCE			
Subject Code	21CSCSP604B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. To provide a basic exposition to the goals and methods of Artificial Intelligence.
3. To apply the techniques in applications which involve perception, reasoning and learning.

Unit -1: Introduction to Artificial Intelligence	**Hours**
What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	**10**
Unit -2: Problem solving	
Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.	**10**
Unit – 3: Knowledge Representation	
Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World	**10**
Unit – 4: Uncertain Knowledge and Reasoning	
Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks.	**10**
Unit – 5: AI present and Future	
Weak AI: Can Machines Act Intelligently? Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence, Agent Components, Agent Architectures, Are We Going in the Right Direction?, What If AI Does Succeed?.	**08**

Data

Text(T) / Reference(R) Books:	
T1	Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Pearson.
T2	Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill
R1	SarojKaushik, “Artificial Intelligence”, Cengage Learning India, 2011
R2	David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.
R3	Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House, Delhi.
W1	https://nptel.ac.in/courses/106105077 https://nptel.ac.in/courses/10610612
W2	https://aima.cs.berkeley.edu https://ai.berkeley,edu/project_overview.htm

Course Outcomes: On completion of this course, students can	
CO1	To introduce basic concepts of AI with its working principles.
CO2	To understand different kinds of heuristic search algorithms to get feasible solutions for AI problems.
CO3	To understand problem reduction concepts using various problem reduction techniques. (Ex: Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem)
CO4	To understand various Knowledge Representation (KR) techniques
CO5	To understand different kinds of Expert Systems.

CLOUD COMPUTING			
Subject Code	21CSCSP604C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To explain the evolving computer model caned cloud computing.
2. To introduce the various levels of services that can be achieved by the cloud.
3. To describe the security aspects of the cloud.
4. To motivate students to do programming and experiment with the various cloud computing environments.

Unit -1: Systems Modeling, Clustering and Virtualization:	**Hours**
Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the Internet, Technologies for Network-Based Systems, System models for Distributed and Cloud Computing, Performance, Security and Energy Efficiency	**10**
Unit -2: Virtual Machines and Virtualization of Clusters and Data Centers	
Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.	**10**
Unit – 3: Cloud Platform Architecture	
Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure	**10**
Unit – 4: Cloud Resource Management and Scheduling	
Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, and Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.	**10**
Unit – 5: Storage Systems	
Evolution of storage technology, storage models, file systems and database, distributed file systems, and general parallel file systems. Google file system.	**08**

Text(T) / Reference(R) Books:	
T1	Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
T2	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
R1	Cloud Computing, A Hands-on approach, Arshadeep Bahga, Vijay Madisetti, University Press
R2	Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
R3	Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

MINING MASSIVE DATASETS			
Subject Code	21CSCSP604D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits– 03			
Course Objective: The course will discuss data mining and machine learning algorithms for analyzing very large amounts of data.			
Unit -1: Introduction			**Hours**
Data Mining: Introduction, Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction, Statistical Limits on Data Mining, Hash Functions, Indexes, Natural Logarithms, Power Laws.			**10**
Unit-2: Map Reduce and the New Software Stack			
Distributed File Systems, Map Reduce, Algorithms Using MapReduce, Extensions to MapReduce, Complexity Theory for MapReduce.			**10**
Unit–3: Mining Data Streams			
The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.			**10**
Unit–4: Frequent Item sets			
The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.			**10**
Unit–5: Clustering and Dimensionality Reduction			
Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces, and Clustering for Streams and Parallelism. Dimensionality Reduction: Eigen values and Eigenvectors of Symmetric Matrices, Principal-Component Analysis, Singular-Value Decomposition, CUR Decomposition			**08**

Text(T) / Reference(R) Books:	
1	1.Mining of Massive Datasets - Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman"

Course Outcomes: On completion of this course, students can	
CO1	Recollecting fundamentals of data mining.
CO2	Apply the concept of Map reduce and data streams for storing and processing of massive data sets
CO3	Analyze the issues underlying the effective applications of massive data sets
CO4	Evaluate different clustering algorithms and analyze various decomposition techniques

DEVOPS LAB			
Subject Code	21CSCSL6060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

1. Write code for a simple user registration form for an event.

2. Explore Git and GitHub commands.

3. Practice Source code management on GitHub. Experiment with the source code written in exercise 1.

4. Jenkins installation and setup, explore the environment.

5. Demonstrate continuous integration and development using Jenkins.

6. Explore Docker commands for content management.

7. Develop a simple containerized application using Docker.

8. Integrate Kubernetes and Docker

9. Automate the process of running containerized application developed in exercise 7 using Kubernetes.

10. Install and Explore Selenium for automated testing.

11. Write a simple program in JavaScript and perform testing using Selenium.

12. Develop test cases for the above containerized application using selenium.

Machine Learning Lab			
Subject Code	21CSCSL6070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

Experiment-1:

Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment-2:

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Experiment-3:

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-4:

Exercises to solve the real-world problems using the following machine learning methods:

a) Linear Regression

b) Logistic Regression

c) Binary Classifier

Experiment-5:

Develop a program for Bias, Variance, Remove duplicates, Cross Validation

Experiment-6:

Write a program to implement Categorical Encoding, One-hot Encoding

Experiment-7:

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:

Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-9:

Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Outcomes (Cos): At the end of the course, student will be able to

- Implement procedures for the machine learning algorithms
- Design and Develop Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms
- Develop Machine Learning algorithms to solve real world problems

Unified Modelling Language Lab			
Subject Code	21CSCSL6080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

OBJECTIVES:

- To capture the requirements specification for an intended software system
- To draw the UML diagrams for the given specification
- To map the design properly to code
- To test the software system thoroughly for all scenarios
- To improve the design by applying appropriate design patterns.

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.

2. Document the Software Requirements Specification (SRS) for the identified system.

3. Identify use cases and develop the Use Case model.

4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.

5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams

6. Draw relevant State Chart and Activity Diagrams for the same system.

7. Implement the system as per the detailed design

8. Test the software system for all the scenarios identified as per the usecase diagram

9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.

10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.

2. Book bank

3. Exam registration

4. Stock maintenance system.

5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

Soft Skills & Aptitude Builder - 2			
Subject Code	21CMAHS6090	IA Marks	15+15
Number of Lecture Hours/Week	2	Exam Marks	35+35
Total Number of Lecture Hours	32	Exam Hours	3
Credits - 2			
Section A, Soft Skills			
Unit – 1: Communicative Competence			**Hours**
Verbal Reasoning: Reading Comprehension-Text Completion- Sentence Equivalence Spotting Errors, Sequencing of Sentences, Parallelism in Structure E-Mail Etiquette, Reporting News Activity: Completing Exercises			**6**
Unit 2: Career and Employability Skills			
What is a Career: Career vs Job, Career Values & Grid, Skills vs Strengths, Spotting Skills/Reflection of Present Skills, Meeting the Expectation of your Employer, Matching your Skills with the Required Skills, Preparing Resume, Preparing for Interviews & Structuring Answers Activity: Resume Building, Interviews			**6**
Section B, Aptitude Builder			
Unit – 3: Time and Work			
Pipes and Cisterns: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours Method, Problems on Alternate Days, Problems on Pipes and Cisterns. **Time, Distance and Speed, Problems on Trains, Boats and Streams:** Relation between Speed, Distance and Time, Converting km/h into m/s and vice versa , Problems on Average Speed, Problems on Relative Speed, Problems on Circular Tracks, Problems on Races **Problems on Trains:** Two Trains Moving in Opposite Direction, Two Trains Moving in same Direction, A Train Crossing a Stationary Object of a Given Length like a Platform or Bridge, A Train Crossing a Stationary Object like a Pole or a Man **Boats and Streams:** Time Based, which can be considered as a Point Object Speed Based, Distance Based, Average Speed Based			**6**
Unit – 4: Logical and Analytical Reasoning			
Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, Complex Arrangement**.** **Clocks :** Finding the Angle When the Time is Given, Finding the Time When the Angle is Known, Relation between Angles, Minutes and Hours, Position of Hands of the Clock, Time Gained or Lost by the Clock, Mirror /Water Image-based Time. **Calendars :** Definition of a Leap Year, Finding the Number of Odd Days, Framing the Year Code for Centuries, Finding the Day of any Random Calendar Date **Syllogisms:** Finding the Conclusions using Venn Diagram Method, Finding the Conclusions using Syllogism Method **Simple Interest:** Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal **Compound Interest:** Definition and Formula for Amount in Compound Interest, Difference between Simple Interest and Compound Interest for 2 Years on the Same Principle and Time Period.			**7**

Unit – 5: Permutations, Probability, Areas and Volumes	
Definition of permutation, Problems on Permutations, Definition of Combinations, problems on Combinations **Probability:** Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards, Problems on Years **Mensuration - 2D:** Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas **Mensuration - 3D:** Problems on Volumes, Problems on Surface Areas	**7**

Text (T) / Reference (R) Books:	
For Units 1 & 2	
T1	Enhance Your Employability Skills, David Winter and Laura Brammar, University of London
T2	R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003
R2	How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill
For Units 3, 4, & 5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A modern approach to Logical reasoning'
R1	Quantitative Aptitude for CAT By Arun sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO 1	learn and practice effective communication skills
CO 2	develop broad career plans, evaluate the employment market, and become industry ready
Section B: Aptitude Builder	
CO 3	develop accuracy on time and distance and units related solutions
CO 4	solve the real-time problems for performing job functions easily
CO 5	solve problems related to permutations and combinations, probability, areas and volumes

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Subject Code	21CSCSN6100	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03

Credits– 03

Course Objectives:

1. The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
2. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
3. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system

Unit -1: Introduction to Traditional Knowledge	**Hours**
Define Traditional Knowledge- Nature and Characteristics- Scope and Importance-kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.	**06**
Unit-2: Basic structure of Indian Knowledge System	
AstadashVidya- 4 Ved - 4 Upaved (Ayurved, Dhanurved, GandharvaVed & SthapthyaAdi), 6 vedanga (Shisha, Kalppa, Nirukha, Vykaran, Jyothisha & Chand),4 upanga(Dharmashastra, Meemamsa, purana & Tharka Shastra).	**06**
Unit–3: Modern Science and Indian Knowledge System	
Indigenous Knowledge, Characteristics- Yoga and Holistic Health care-case studies.	**06**
Unit–4: Protection of Traditional Knowledge	
The need for protecting traditional knowledge - Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge	**06**
Unit–5: Impact of Traditions	
Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain &Boudh - Indian Artistic Tradition - Chitrakala, Moorthikala, Vasthukala , Sthapthya, Sangeetha, NruthyaYevamSahithya	**06**

Text(T) / Reference(R) Books:	
T1	Traditional Knowledge System in India, by Amit Jha, 2009.
T2	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
T3	Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, BharatiyaVidya
R1	Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
R2	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
	Web Links: 1.https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/ 3.https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

Course Outcomes: On completion of this course, students can	
CO1	Identify the concept of Traditional knowledge and its importance.
CO2	Classify the Indian Traditional Knowledge
CO3	Compare Modern Science with Indian Traditional Knowledge system.
CO4	Analyze the role of Government in protecting the Traditional Knowledge
CO5	Understand the impact of Philosophical tradition on Indian Knowledge System.

Semester VII (Fourth year IV-I)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PE	21CSCST701X	Professional Elective -III	3	0	0	3
2	PE	21CSCST702X	Professional Elective - IV	3	0	0	3
3	PE	21CSCST703X	Professional Elective - V	3	0	0	3
4	OE	21CSCSP704X	Open Elective Course	3	0	0	3
5	OE	21CSXXO705X	Open Elective Course	3	0	0	3
6	HS	21CSMST7060	Management Science	0	0	3	3
7	SOC	21CSCSS7070	**Skill Oriented Course** ETL Spark	0	0	3	2
	Summer Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)			0	0	0	3
						Total credits	**23**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Professional Elective - III	
Code	**Course Title**
21CSCSP701A	Network Protocols
21CSCSP701B	Ad-hoc & Sensor Networks
21CSCSP701C	Mobile Computing
21CSCSP701D	Cyber Security

Professional Elective - IV	
Code	**Course Title**
21CSCSP702A	Mobile Application Development
21CSCSP702B	Social Networks & Semantic Web
21CSCSP702C	Computer Vision
21CSCSP702D	Ethical Hacking

Professional Elective - V	
Code	**Course Title**
21CSCSP703A	Block-Chain Technologies
21CSCSP703B	Cryptography & Network Security
21CSCSP703C	Deep Learning
21CSCSP703D	Neural Networks and Soft Computing

NETWORK PROTOCOLS			
Subject Code	21CSCSP701A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: IP ADDRESSING	**Hours**
Decimal Notation-Classes, special addresses, A simple Internet-Unicast and Broadcast addresses, Applying for IP addresses, Private networks. *SUBNETTING AND SUPERNETTING:* Subnetting, Masking-Examples of Subnetting, Variable length Subnetting, Super netting. *INTERNET PROTOCOL:* Datagram Fragmentation, Options, Checksum, IP design. ARP, RARP.	10
Unit -2: INTERNET CONTROL MESSAGE PROTOCOL	
Types of Messages, Message formats, Error reporting, Query, Checksum, ICMP design. *INTERNET GROUP MANAGEMENT PROTOCOLS:* Multicasting, IGMP, Encapsulation, Multicast Backbone, IGMP design. *USER DATAGRAM PROTOCOL:* Process to process communication, User datagram, Checksum, UDP operation, uses of UDP, UDP design.	**10**
Unit – 3: *TRANSMISSION CONTROL PROTOCOL*	
Process to Process communication, TCP Services, Segment, Options, Checksum, Flow control, Error Control, TCP Timers, Connection, State Transition Diagram, Congestion Control, TCP operation, TCP Design. *APPLICATION LAYER AND CLIENT-SERVER MODEL:* Client-server Model, Concurrency-Processes, BOOTP-DHCP, *DOMAIN NAME SYSTEM:* Name Space, Domain name Space, Distribution of Namespace, DNS in the Internet, Resolution, DNS Messages, Types of Records, Compression, DDNS Encapsulation.	**10**
Unit – 4: TELNET AND RLOGIN	
Concept-Network Virtual Terminal, NVT character set, Embedding, Option Negotiation, Sub option Negotiation, Controlling Server, Out of Band signalling, Escape character, Mode of Operation, Examples, User Interface, Rlogin, Security Issue. *FILE TRANSFER PROTOCOL:* Connections, Communication-Command Processing-File, Transfer-User, Interface-Anonymous, FTP. *TRIVIAL FILE TRANSFER PROTOCOL:* Messages, Connection, Data Transfer, UDP ports, TFTP Example, TFTP options, Security, Applications.	**10**
Unit – 5: HYPERTEXT TRANSFER PROTOCOL	
HTTP overview, Proxy, Gateway, Tunnel, Cache, Messages, General Header Fields, Cache Control, Connection, Request Methods, Request Header Fields, Response Messages, Response Header Fields, Entity Header Fields, Client/Server Authentication. *SOCKET INTERFACE:* Definitions, Sockets, Byte ordering, Address Transformation, Byte manipulation, Function-	**08**

Information about Remote, Host- Socket System Calls, Connectionless Iterative server, UDP Client/Server Programs, Connection oriented Concurrent Server, TCP Client/Server Programs	

Text(T) / Reference(R) Books:	
T1	TCP/IP Protocol Suite. Behrouz A. Forouzan (TMH edition).
R1	Internetworking with TCP/IP. D. E. Comer (PHI publications).
W1	https://www.coursera.org/learn/network-protocols-architecture
W2	https://www.perpetual-solutions.com/training-course/436/hands-on-tcp-ip-and-internet-protocols

Course Outcomes: On completion of this course, students can	
CO1	Create, test and debug Android application by setting up Android development environment
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices. Infer long running tasks and background work in Android applications.
CO3	Demonstrate methods in storing, sharing and retrieving data in Android applications.
CO4	Analyze performance of android applications and understand the role of permissions and security.
CO5	Describe the steps involved in publishing Android application to share with the world.

Ad-Hoc & SENSOR NETWORKS			
Subject Code	21CSCSP701B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- Upon completion of this course, students will be able to know the characteristics of adhoc and sensor networks, study various MAC and routing protocols, and provide security to MANET and WSN.

Unit -1: Ad-HOC Introduction	**Hours**
Issues in Ad-Hoc Wireless Networks, MAC Protocols Issues, Classifications of MAC protocols, Multi-channel MAC & Power control MAC protocol.	**10**
Unit -2: Ad-HOC Network routing & TCP	
Issues, Classifications of routing protocol, Hierarchical and Power aware, Multicast routing, Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues, TCP Over Ad Hoc, Feedback based, TCP with explicit link, TCP Bus, Ad Hoc TCP, and Split TCP.	**10**
Unit - 3: WSN and MAC	
Introduction, Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols, self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.	**10**
Unit - 4: WSN Routing, Localization & QOS	
Issues in WSN routing, OLSR, AODV. Localization, Indoor and Sensor Network, Localization, QOS in WSN.	**10**
Unit - 5: Mesh Networks	
Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Opportunistic routing, Self-configuration and Auto configuration Capacity, Models, Fairness, Heterogeneous Mesh Networks, Vehicular Mesh Networks.	**08**

Text(T) / Reference(R) Books:	
T1	Mobile Ad hoc Networking, Marco Conti, Silvia Giordano, Ivan Ivan Stojmenovic Stefano Basagni, Wiley, Second Edition,2015
T2	Ad Hoc Wireless Networks – Architectures and Protocols, C.Siva Ram Murthy and B.Smanoj, Pearson Education, 2006.
R1	Ad hoc Networking, Perkins, Pearson Education, 2008.
R2	Wireless Sensor Networks, Feng Zhao and Leonidas Guibas, Morgan Kaufman Publishers, 2004.
R3	Ad Hoc Mobile Wireless Networks, C.K.Toh,
R4	Wireless Mesh Networking, Thomas Krag and Sebastin Buettrich, O'Reilly Publishers, 2007.
W1	https://www.coursera.org/lecture/iot/lecture-3-2-manets-ED6nz
W2	https://nptel.ac.in/courses/106105160/

Course Outcomes: On completion of this course, students can	
CO1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2	Explain the various adhoc routing protocols and transport layer mechanisms
CO3	Classify the design issues and different categories of MAC protocols
CO4	Illustrate the issues of routing in WSN and QoS related performance measurements
CO5	Comprehend the various sensor network Platforms, tools and applications

MOBILE COMPUTING			
Subject Code	21CSCSP701C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1: Introduction			**Hours**
Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments, and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS. *(Wireless) Medium Access Control (MAC):* Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)			10
Unit -2 : Mobile Network Layer			
IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP.			**10**
Unit – 3: Mobile Transport Layer			
Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. *Database Issues:* Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.			**10**
Unit – 4: Data Dissemination and Synchronization			
Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.			**10**
Unit – 5: Mobile Ad hoc Networks			
Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Mobile Agents, Service Discovery. *Protocols and Platforms for Mobile Computing:* WAP, Bluetooth, XML, J2ME, Java Card, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.			**08**

Text(T) / Reference(R) Books:	
T1	Mobile Communications, Jochen Schiller, Addison-Wesley, Second Edition, 2009
T2	Mobile Computing, Raj Kamal, Oxford University Press, 2007.
R1	Mobile Computing, Technology Applications and Service Creation, ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, Second Edition, Mc Graw Hill
R2	Principles of Mobile Computing, UWE Hansmann, LotherMerk, Martin S. Nocklous, Thomas Stober, Second Edition, Springer.
W1	https://swayam.gov.in/course/3696-mobile-computing
W2	https://onlinecourses.nptel.ac.in/noc16_cs13/preview

Course Outcomes: On completion of this course, students can	
CO1	To think and develop new mobile application.
CO2	To take any new technical issue related to this new paradigm and come up with a solution(s).
CO3	To develop new ad hoc network applications and/or algorithms/protocols.
CO4	To understand & develop any existing mobile time environment.
CO5	To understand & develop new protocol related to mobile time environment.

CYBER SECURITY			
Subject Code	21CSCSP701D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. The Cyber Security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
2. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

Unit -1: Introduction to Cybercrime	**Hours**
Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens	10
Unit -2: Cyber offenses	
How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cyber Cafe, and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing. *Cybercrime Mobile and Wireless Devices:* Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, *Mobile Devices:* Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	**10**
Unit – 3: Tools and Methods Used in Cybercrime	
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, *Phishing, and Identity Theft:* Introduction, Phishing, Identity Theft (IDTheft)	**10**
Unit – 4: Cybercrimes and Cybersecurity	
Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies?	**10**

Unit – 5: Understanding Computer Forensics	
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Ant forensics	**08**

Text(T) / Reference(R) Books:	
T1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley.
T2	Principles of Information Security, Micheal E.Whitman and Herbert J.Mattord, Cengage Learning.
R1	Information Security, Mark Rhodes, Ousley, MGH.
W1	https://www.edx.org/learn/cybersecurity
W2	https://www.cyberdegrees.org/resources/free-online-courses/

Course Outcomes: On completion of this course, students can	
CO1	Cyber Security architecture principles
CO2	Identifying System and application security threats and vulnerabilities
CO3	Identifying different classes of attacks
CO4	Cyber Security incidents to apply appropriate response
CO5	Describing risk management processes and practices, Evaluation of decision-making outcomes of Cyber Security scenarios

Mobile Application Development			
Subject Code	21CSCSP702A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Provide knowledge on tools required for Mobile Application Development using Android.
2. Discuss android User Interface using Views.
3. Impart Android User Interface for pictures and menus.
4. Introduce knowledge on android databases.

Unit -1: Started with Android and Android Studio	**Hours**
What Is Android, Required Tools, Launching First Android Application, Exploring the IDE, Debugging Applications, and Publishing Applications.	10
Unit -2: Android User Interface	
Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Creating the User Interface Programmatically, Basic Views, Picker Views, List Views	**10**
Unit – 3: Activities, Fragments, and Intents	
Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.	**10**
Unit – 4: Data Persistence	
Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.	**10**
Unit – 5: Messaging and Location-Based Services	
SMS Messaging, Sending Email, Displaying Maps, Getting Location Data, Monitoring a Location.	**08**

Text(T) / Reference® Books:	
T1	Beginning Android® Programming with Android Studio, J..F.. DiMarzio, John Wiley & Sons, Inc. (Wrox)
T2	Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox)
R1	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox)
R2	Android Programming: The Big Nerd Ranch Guide, Bill Phillips, Chris Stewart and Kristin Marsicano, Big Nerd Ranch, LLC.

W1	https://developer.android.com/
W2	https://www.coursera.org/courses?query=mobile%20app%20development

Course Outcomes: On completion of this course, students can	
CO1	Create, test and debug Android application by setting up Android development environment
CO2	Implement an adaptive, responsive user interface that work across a wide range of devices.
CO3	Design and develop individual components that can communicate with each other by using intents and notifications.
CO4	Design and develop solutions for real world problems with android mobile applications.
CO5	Demonstrate problem solving skills to create applications for mobile devices.

SOCIAL NETWORKS & SEMANTIC WEB			
Subject Code	21CSCSP702B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To learn Web Intelligence
2. To learn Knowledge Representation for the Semantic Web
3. To learn Ontology Engineering
4. To learn Semantic Web Applications, Services and Technology
5. To learn Social Network Analysis and semantic web

Unit -1: Web Intelligence	**Hours**
Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.	10
Unit -2: Knowledge Representation for the Semantic Web	
Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.	**10**
Unit – 3: Ontology Engineering	
Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.	**10**
Unit – 4: Semantic Web Applications, Services and Technology	
Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods	**10**
Unit – 5: Social Network Analysis and semantic web	
What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.	**08**

Text(T) / Reference® Books:	
T1	Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science.
T2	Social Networks and the Semantic Web, Peter Mika, Springer
R1	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
R2	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
R3	Information sharing on the semantic Web – Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications.
R4	Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate social network analysis and measures.
CO2	Analyze random graph models and navigate social networks data.
CO3	Apply the network topology and Visualization tools.
CO4	Analyze the experiment with small world models and clustering models.
CO5	Compare the application driven virtual communities from social network Structure.

COMPUTER VISION			
Subject Code	21CSCSP702C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To introduce students the fundamentals of image formation.
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition.
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4. To provide the student with programming experience from implementing computer vision and object recognition applications.

Unit -1: Introduction	**Hours**
Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighborhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization.	**10**
Unit -2: Feature Detection and Matching	
Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature-Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric Intrinsic Calibration.	**10**
Unit – 3: Structure and Motion	
Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion	**10**
Unit – 4: Image Stitching	
Motion Models, Global Alignment, Composing, Computational Photography: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis.	**10**
Unit – 5: 3D Reconstruction	
Shape From X, Active Range Finding, Surface Representation, Point based Representation, Volumetric Representation, Model-based Reconstruction, Recovering Texture Maps and Albedos, Image-based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumi graphs, Environment Mattes, Video-based Rendering.	**08**

Text(T) / Reference® Books:	
T1	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011.
T2	Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012.
R1	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
R2	Haralick & Shapiro, "Computer and Robot Vision", Vol II
R3	G_erard Medioni and Sing Bing Kang "Emerging topics in computer vision"166
R4	https://onlinecourses.nptel.ac.in/noc22_ee48/preview

Course Outcomes: On completion of this course, students can	
CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
CO2	Describe known principles of feature detection and matching.
CO3	Describe basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal.
CO4	Suggest a design of a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths.
CO5	

ETHICAL HACKING			
Subject Code	21CSCSP702D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
2. The course includes-Impacts of Hacking; Types of Hackers; Information Security Models, Information Security Program, Business Perspective, Planning a Controlled Attack.
3. Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration).

Unit -1: Introduction to Hacking:	**Hours**
Hacking, Types and phases of hacking, Introduction to Ports & Protocols: Ports, Protocols, Primary Network Types, Virtualization & Introduction to Kali Linux: Virtualization, Virtualization software, supported platforms, Introduction to Penetration Testing: Penetration test, Categories and Types of Penetration tests, Structure of Penetration Test Report.	**10**
Unit -2: Footprinting & Scanning	
Footprinting: Footprinting, Types, Using ping and ns Lookup commands in Windows command line, Scanning: Scanning, Basics of Scanning, Basic Techniques of Scanning, Enumerating DNS using dns enum, Performing flag scan using hping3.	**10**
Unit – 3: Hacking into System	
System Hacking, Password Cracking, Default password databases, Manual and Automated Password Cracking, Process of System Hacking, Using Keyloggers, Trojans & Backdoors: Trojans, Working of Trojan, Infection Techniques, Attack, Lifecycle and Classification of Virus, Worms, Virus Construction Kit.	**10**
Unit – 4: Sniffing, Packet Analysis & Session Hijacking	
Sniffing, Packet Analysis, Types of Sniffing, Active and Passive Sniffing Techniques, Session Hijacking, Social Engineering: Social Engineering, Process, Identity Theft, Human and Computer Based Social Engineering Techniques, Phishing Process, Types of Phishing Attacks, Social Engineering Toolkit (SET)	**10**
Unit – 5: Cryptography	
Cryptography, Digital Signature, Hash Functions, Steganography: Steganography Process, watermarking, Steganography Methods and Attacks, Steganography tools, Vulnerability Assessment: Vulnerability, The Open Web	**08**

Application Security Project (OWASP), Prevention, Damn Vulnerable Web Application (DVWA), installation and testing of DVWA	

Text(T) / Reference® Books:	
T1	Hacking: Be a Hacker with Ethics, Harsh Bothra, Khanna Publications, 2019
T2	Ethical Hacking and Penetration Testing Guide, Rafay Baloch, 2014
R1	Kali Linux Wireless Penetration Testing Beginner's Guide, Vivek Ramachandran, Cameron Buchanan, Packt Publishing, 2015
R2	SQL Injection Attacks and Defense, 1st Edition, Justin Clarke-Salt, Syngress Publication
R3	Mastering Modern Web Penetration Testing, Prakhar Prasad, Packt Publishing, October 2016

Course Outcomes: On completion of this course, students can	
CO1	Explain the concepts related to hacking, ports and protocols, pen testing and virtualization.
CO2	Determine the applicable footprinting techniques and scanning methods.
CO3	Explain the process of system hacking and Explain the concepts Trojans, backdoors, worms and virus and it's counter measures.
CO4	Demonstrate systematic understanding of the concepts of Sniffing and Social Engineering and it's attacks.
CO5	Determine the applicable methods of cryptography, steganography and Vulnerability Assessment.

BLOCKCHAIN TECHNOLOGIES			
Subject Code	21CSCSP703A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To assess blockchain applications in a structured manner.
2. To impart knowledge in blockchain techniques and able to present the concepts clearly and structured.
3. To get familiarity with future currencies and to create own crypto token.

Unit -1: Introduction	**Hours**
Overview of Blockchain, public ledgers, bitcoin, smart contracts, block in a blockchain, transactions, distributed consensus, public vs private blockchain, understanding cryptocurrency to blockchain, permissioned model of blockchain, overview of security aspects of blockchain, cryptographic hash function, properties of a hash function, hash pointer and Merkle tree, digital signature, public key cryptography, a basic cryptocurrency.	**10**
Unit -2: Understanding blockchain with cryptocurrency	
Creation of coins, payments and double spending, bitcoin scripts, bitcoin P2P network, transaction in bitcoin network, block mining, block propagation and block relay, distributed consensus in open environments, consensus in a bitcoin network, Proof of Work (PoW)- Basic Introduction, hashcashPoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of burn and proof of elapsed time, the life of a bitcoin miner, Mining- Difficulty, mining pool.	**10**
Unit – 3: Permissioned BlockChain	
Permissioned model and usecases, design issues for permissioned blockchains, execute contracts, state machine replication, overview of consensus models for permissioned block chain, Distributed consensus in closed environment, paxos, RAFT consensus, Byzantine general problem, Byzantine fault tolerance system, Lamport-Shostak-Pease BFT algorithm, BFT over Asynchronous systems.	**10**
Unit – 4: Enterprise application of Blockchain	
Cross border payments, Know Your Customer, Food security, Mortgage over blockchain, Blockchain enabled trade, trade finance network, supply chain financing, identity on blockchain.	**10**
Unit – 5: Blockchain application development	
Hyperledger fabric- architecture, identities and policies, membership and access control, channels, transaction validation, writing smart contract using Hyperledger fabric, writing smart contract using Ethereum, overview of Ripple and Corda.	**08**

Text(T) / Reference(R) Books:

T1	Block Chain: Blueprint for a new economy, Melanie Swan, O'Reilly, 2015.
T2	Block Chain: The Block Chain for Beginners- Guide to Block Chain Technology and Leveraging Block Chain Programming, Josh Thompsons
R1	Block Chain Basics, Daniel Drescher, Apress; 1st edition, 2017
R2	Block Chain and Crypto Currencies, Anshul Kaushik, Khanna Publishing House, Delhi.
R3	Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, Imran Bhashir, Packt Publishing.
W1	https://www.edx.org/learn/blockchain
W2	https://www.coursera.org/courses?query=blockchain

Course Outcomes: On completion of this course, students can	
CO1	Understand block chain technology.
CO2	Develop block chain-based solutions
CO3	Write smart contract using Hyperledger Fabric and Ethereum frameworks.
CO4	Build and deploy block chain application for on premise and cloud-based architecture.
CO5	Integrate ideas from various domains and implement them.

CRYPTOGRAPHY AND NETWORK SECURITY			
Subject Code	21CSCST6020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)

2. Public-key cryptography (RSA, discrete logarithms),

3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes,

4. Email and web security, viruses, firewalls, digital right management, and other topics.

Unit -1: Basic Principles	**Hours**
Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography, Symmetric Encryption, Mathematics of Symmetric Key Cryptography.	**10**
Unit -2: Symmetric Encryption	
Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.	**10**
Unit - 3: Asymmetric Encryption	
Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography.	**10**
Unit - 4:	
Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.	**10**
Unit - 5: Security at application layer	
PGP and S/MIME, Security at the Transport Layer: SSL and TLS. Security at the Network Layer: IPSec, System Security.	**08**

Text(T) / Reference® Books:	
T1	Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, (3e) Mc Graw Hill.
T2	Cryptography and Network Security, William Stallings, (6e) Pearson.
T3	Everyday Cryptography, Keith M.Martin, Oxford.
R1	Network Security and Cryptography, Bernard Meneges, Cengage Learning.
R2	Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.
W1	https://onlinecourses.nptel.ac.in/noc19_cs28/preview
W2	https://www.coursera.org/learn/crypto

Course Outcomes: On completion of this course, students can	
CO1	Explain the network security vulnerabilities/attacks and symmetric encryption schemes.
CO2	Describe Symmetric key encryption techniques and mathematical foundations for cryptography.
CO3	Describe public key encryption techniques and mathematical foundations for cryptography.
CO4	Explain authentication and digital signature protocols.
CO5	Discuss the authentication applications, web and E-mail security mechanisms.

DEEP LEARNING			
Subject Code	21CSCSP703C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Learn deep learning methods for working with sequential data.
2. Learn deep recurrent and memory networks.
3. Learn deep Turing machines.
4. Apply such deep learning mechanisms to various learning problems.
5. Know the open issues in deep learning, and have a grasp of the current research directions.

Unit -1: Fundamentals of Deep Learning	**Hours**
Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, Fundamentals of Machine Learning: Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting.	**08**
Unit -2: Introducing Deep Learning	
Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks.	**10**
Unit – 3: Neural Networks	
Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification.	**10**
Unit – 4: Convolutional Neural Networks	
Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation, Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch.	**10**
Unit – 5: Interactive Applications of Deep Learning	
Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. **Deep Learning Research**: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks.	**08**

Text(T) / Reference(R) Books:	
T1	Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
T2	Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
T3	Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
T4	Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412
R1	Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
R2	Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
R3	Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.
W1	Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
CO2	Discuss the Neural Network training, various random models.
CO3	Explain the Techniques of Keras, TensorFlow, Theano and CNTK
CO4	Classify the Concepts of CNN and RNN.
CO5	Implement Interactive Applications of Deep Learning.

NEURAL NETWORKS AND SOFT COMPUTING			
Subject Code	21CSCSP703D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To introduce the foundations of Artificial Neural Networks.
2. To acquire the knowledge on Soft Computing Concepts.
3. To learn various types of Genetic algorithms and its applications.
4. To gain knowledge to apply optimization strategies.

Unit -1: Soft Computing and Artificial Intelligence	**Hours**
Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Interference, Semantic Networks, Frames, Objects, Hybrid Models.	10
Unit -2: Artificial Neural Networks and Paradigms	
: Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptron, Multilayer Perceptron, Back propagation Networks, Kohnen's self organizing networks, Hopfield network, Applications of NN.	**10**
Unit – 3: Fuzzy Logic	
Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule-based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.	**10**
Unit – 4: Genetic Algorithms and Swarm Optimizations	
Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.	**10**
Unit – 5: Hybrid Systems	
Neuro fuzzy hybrid systems, Adaptive neuro fuzzy inference systems, Fuzzy backpropagation network, Genetic neuro hybrid system, Genetic algorithm based backpropagation network, Genetic-fuzzy hybrid systems.	**08**

Text(T) / Reference(R) Books:	
T1	Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
T2	S. Rajasekaran & G. A. Vijayalakshmi Pai “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”, PH.
R1	S. N. Sivanandam & S. N. Deepa ”Principles of Soft Computing” Wiley – India, 2nd Edition, 2007.
R2	Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall.
R3	Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
R4	Zimmermann, “Fuzzy Set Theory and its Application”, 3rd Edition.

Course Outcomes: On completion of this course, students can	
CO1	Understand the concepts of Artificial intelligence and soft computing techniques
CO2	Analyze the concepts of Neural Networks and select the Learning Networks in modeling real world systems.
CO3	Implement the concepts of Fuzzy reasoning and concepts of Genetic algorithm and its applications to soft computing.
CO4	Classify Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization.
CO5	Design hybrid system incorporating neural network, genetic algorithms, fuzzy systems.

ETL DESIGN PROCEDURES-SPARK

Subject Code	21CSCSS7070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objective:

- Get exposure on Spark for ETL

Course Outcomes:

By completing the course the students will be able to:

- Develop various applications for ETL with Spark

List of Experiments:

1. Write a program to create a Spark Session and read the data from CSV file
2. Write a program to group record of Supermarket's sales data of Kaggle Dataset by Gender
3. Write a program to create a Spark Session and display DataFrame of employee.json
4. Write a program to perform various operations of Spark SQL
5. Write a program to create a new data pipeline with Apache Spark
6. Write a program to Run SQL queries on the data in Parquet table
7. Write a program to develop Parquet table to a platform data container.
8. Write a program to Run SQL queries on the data in NoSQL table
9. Write a program to change the data in an existing Delta Lake table
10. Write a program to create a new ingestion pipeline with Apache Spark

MANAGEMENT SCIENCE			
Subject Code		IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course objectives:

1. To understand the concept of Management its nature importance, Management theories, concept of decision making and organization principles and structures.
2. To understand the concept of production management in the organization. Work study, SQC, inventory management and its techniques.
3. To understand the concept of HRM and its functions, Marketing Management, Strategic management its components.
4. To understand the concept of project management PERT, CPM and Project Crashing.
5. To understand the concepts of recent trends in management

Unit -I: Introduction to Management	**Hours**
Concept –nature and importance of Management – Functions of Management – Evaluation of Management thought- Theories of Motivation –Decision-making process – Designing organization Structure - Principles of organization - Types of organization structure.	**10**
Unit -II: Operations Management	
Nature & Objectives of OM-Production Methods-Plant Location & Layout Study &its significance – Work study- Statistical Quality Control-Control charts (P-chart, R-chart, and C chart). Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis(HML,SDE, VED, and FSN analysis).	**10**
Unit-III: Functional Management & Strategic Management	
Functional Management: Concept of HRM, HRD and PMIR-Functions of HRM - Marketing Management- Functions of Marketing, Marketing strategies based on product Life Cycle, Channels of distributions. **Strategic Management**: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis-Steps in Strategy Formulation and Implementation, Generic Strategy alternatives	**10**
Unit –IV: Project Management: (PERT/CPM)	
Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).	**10**
Unit-V: Contemporary Management Practices	
Basic concepts of MIS, MRP, Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma, Supply Chain Management, Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.	**08**

Text(T) / Reference(R) Books:	
T1	Dr. P. Vijaya Kumar & Dr. N. Appa Rao, '*Management Science'* Cengage, Delhi, 2012.
T2	Dr. A. R. Aryasri, *Management Science'* TMH 2011.
R1	Koontz & Weihrich: 'Essentials of Management' TMH 2011
R2	Seth & Rastogi: Global Management Systems, Cengage Learning, Delhi, 2011.
R3	Robbins: Organizational Behaviors, Pearson Publications, 2011
R4	Kanishka Bedi: Production & Operational Management, Oxford Publications, 2011.
R5	Manjunath: Management Science, Pearson Publications, 2013.
R6	Biswajit Patnaik: Human Resource Management, PHI, 2011.
R7	Hitt and Vijaya Kumar: Strategic Management, Cengage Learning.

Course Outcomes: On completion of this course, students can	
CO1	Students are able to understand the concept and functions of Management, and Theories of Motivation, Styles of Leadership.
CO2	Students are able to understand the Statistical Quality Control Techniques, Methods of inspection, the concept of Inventory Management and Control.
CO3	Students are understand the functional areas of organization i.e., Marketing Management, Human Resource Management, and Strategic Management
CO4	Students are able to understand Project Management Techniques.
CO5	Students are able to Understand the various contemporary issues in Management Practices like TQM and BPO etc.

OPEN ELECTIVES COURSES OFFERED BY CSE

TO

OTHER DEPARTMENTS

V SEM OPEN ELECTIVE COURSES

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXCSO50XA	Data Structures through C	3	0	0	3
2.	21XXCSO50XB	Operating Systems Concepts	3	0	0	3
3.	21XXCSO50XC	Java Programming	3	0	0	3

VI SEM OPEN ELECTIVE COURSES

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXCSO60XA	R Programming	3	0	0	3
2.	21XXCSO60XB	Designing Data Base Management Systems	3	0	0	3
3.	21XXCSO60XC	APP Technologies	3	0	0	3

VII SEM OPEN ELECTIVE COURSES

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXCSO70XA	Web Technologies	3	0	0	3
2.	21XXCSO70XB	Artificial Intelligence	3	0	0	3
3.	21XXCSO70XC	Software Engineering	3	0	0	3

DATA STRUCTURES THROUGH C			
Subject Code	21XXCSO50XA	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Operations on linear data structures and their applications.
2. The various operations on linked lists.
3. The basic concepts of Trees, Traversal methods and operations.
4. Concepts of implementing graphs and its relevant algorithms.
5. Sorting and searching algorithms.

Unit -1: INTRODUCTION TO DATA STRUCTURE	**Hours**
Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best- and worst-case analysis), Types of Data Structures- Linear & Non-Linear Data Structures. Sorting and Searching: Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	**10**
Unit -2: LINEAR DATA STRUCTURE	
Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion. Queue: Representation Of Queue, Operations On Queue, Circular Queue, Double Ended Queue, Applications of Queue.	**10**
Unit – 3: LINKED LIST	
Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	**10**
Unit – 4: NON-LINEAR DATA STRUCTURE	

Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees to Binary Trees, Applications of Trees.	**10**
Unit – 5:GRAPHS	
Graph-Matrix Representation of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	**08**

Text(T) / Reference(R) Books:	
T1	Data Structures using C -By Reema Thareja - OXFORD Higher Publication
T2	Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International
R1	Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed
R2	Fundamentals of Data Structures in C++-By Sartaj Sahani.
R3	Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher Thomson Learning
W1	https://www.coursera.org/specializations/data-structures-algorithms
W2	https://online-learning.harvard.edu/course/data-structures-and-algorithms

Course Outcomes: On completion of this course, students can	
CO1	Choose appropriate data structure as applied to specified problem definition.
CO2	Handle operations like searching, insertion, deletion, traversing mechanism etc.
CO3	Apply concepts learned in various domains like DBMS
CO4	Apply concepts learned in various domains like compiler construction
CO5	Use linear and non-linear data structures like stacks, queues , linked list

OPERATING SYSTEMS			
Subject Code	21XXCSO50XB	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: Operating Systems Overview	**Hours**
Computer system organization, Operating system structure, Process, memory, storage management, Protection and security, Distributed systems, Computing Environments, Open-source operating systems, OS services, User operating-system interface.	**10**
Unit -2 : System Calls & IPC	
System calls, Types, System programs, OS structure, OS generation, System Boot Process concept, scheduling (Operations on processes, Cooperating processes, Inter-process communication), Multi-threading models	**10**
Unit - 3: Process Management	
Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling, Multiple processor scheduling Operating system, Algorithm Evaluation, The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical regions, Monitors.	**10**
Unit - 4: Memory Management & Dead lock	
System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock. Storage Management: Swapping, Contiguous memory allocation, Paging, Segmentation Virtual Memory Background, Demand paging, copy on write, Page replacement and various Page replacement algorithms, Allocation of frames, Thrashing.	**10**
Unit - 5: I/O Systems	
File concept, Access methods, Directory structure, Filesystem mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap-space management, Protection.	**08**

Text(T) / Reference(R) Books:	
T1	Operating System Concepts Essentials, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons Inc., 2010.
T2	Operating System Concepts, 9th Edition, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley and Sons Inc., 2012
T3	Operating Systems, Second Edition, S Halder, Alex A Aravind, Pearson Education, 2016
T4	Operating Systems – Internals and Design Principles, 7th Edition, William Stallings, Prentice Hall, 2011
R1	Modern Operating Systems, Second Edition, Andrew S. Tanenbaum, Addison Wesley, 2001.
R2	Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education, 1996.
R3	Operating Systems: A Concept-based Approach, Second Edition, D M Dhamdhere, Tata McGraw-Hill Education, 2007
R4	Operating Systems: Internals and Design Principles, Seventh Edition, William Stallings, Prentice Hall, 2011
W1	https://www.coursera.org/courses?query=operating%20system
W2	https://onlinecourses.nptel.ac.in/noc16_cs10/preview

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate the evolution of Computer System organization and Operating system services.
CO2	Design solutions for process synchronization problems by using System calls and Inter process communication.
CO3	Identify the functionality involved in process management concepts like scheduling and synchronization.
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze services of I/O subsystems and mechanisms of security & protection.

JAVA PROGRAMMING			
Subject Code	21XXCSO50XC	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Understanding the OOP's concepts, classes and objects, threads, files, applets, swings and act.
2. This course introduces computer programming using the JAVA programming language with object-oriented programming principles.
3. Emphasis is placed on event-driven programming methods, including creating and manipulating objects, classes, and using Java for network level programming and middleware development.

Unit -1: Introduction to OOP	**Hours**
procedural programming language and object-oriented language, principles of OOP, applications of OOP, history of java, java features, JVM, program structure. Variables, primitive data types, identifiers, literals, operators, expressions, precedence rules and associativity, primitive type conversion and casting, flow of control.	**10**
Unit -2 : Classes and objects	
Classes and objects, class declaration, creating objects, methods, constructors and constructor overloading, garbage collector, importance of static keyword and examples, this keyword, arrays, command line arguments, nested classes.	**10**
Unit – 3: Inheritance	
Inheritance, types of inheritance, super keyword, final keyword, overriding and abstract class. Interfaces, creating the packages, using packages, the importance of CLASSPATH and java.lang package. Exception handling, the importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions	**10**
Unit – 4: Multithreading	
Introduction, thread life cycle, creation of threads, thread priorities, thread synchronization, communication between threads. Reading data from files and writing data to files, random access file.	**10**
Unit – 5: Applet	
Applet class, Applet structure, Applet life cycle, sample Applet programs. Event handling: event delegation model, sources of event, Event Listeners, adapter	**08**

classes, inner classes. AWT: introduction, components and containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Container class, Layouts, Menu and Scrollbar.	

Text(T) / Reference(R) Books:	
T1	The complete Reference Java, 8th edition, Herbert Schildt, TMH
T2	Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford
R1	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
W1	https://www.coursera.org/courses?query=java
W2	https://www.udemy.com/java-tutorial/

Course Outcomes: On completion of this course, students can	
CO1	Understand Java programming concepts and utilize Java Graphical User Interface in Program writing.
CO2	Write, compile, execute and troubleshoot Java programming for networking concepts.
CO3	Build Java Application for distributed environment.
CO4	Design and Develop multi-tier applications.
CO5	Identify and Analyze Enterprise applications.

R PROGRAMMING			
Subject Code	21XXCSO60XA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes**.**	10
Unit -2 :	
R Programming Structures, Control Statements, Loops,-Looping Over Nonvector Sets,- If-Else Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation- Extended Extended Example: A Binary Search Tree.	**10**
Unit – 3: Math and Simulation in R	
Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files	**10**
Unit – 4: Graphics	
Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,- ANOVA.	**10**
Unit – 5: Linear Models	
Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests	**08**

Text(T) / Reference(R) Books:	
T1	The Art of R Programming, Norman Matloff, Cengage Learning

T2	R for Everyone, Lander, Pearson
R1	R Cookbook, PaulTeetor, Oreilly
R2	R in Action, Rob Kabacoff, Manning
W1	https://www.edx.org/learn/r-programming
W2	https://www.coursera.org/learn/r-programming

Course Outcomes: On completion of this course, students can	
CO1	Identify the data types in R Programming Language.
CO2	Implement the control and functions with recursion and without recursion.
CO3	Implement the statistical and probabilistic functions to review, manipulate and summarize data-sets in R
CO4	Perform appropriate statistical tests using R Create and edit visualizations
CO5	Interpret data-sets to create testable hypotheses and identify appropriate statistical tests

DESIGNING DATABASE MANAGEMENT SYSTEMS			
Subject Code	21XXCSO60XB	IA Marks	30
Number of Lecture Hours/week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1: Introduction to Databases			Hours
Traditional file-based systems and their limitations, Database approach (DBMS) and its components, Roles in the database environment, Advantages and disadvantages of database systems, Distributed databases.			10
Unit -2 : The Relational Model			
Definition of relational data structures, database relations and keys, Representation of relational database schemas, Relational Algebra, Relational integrity (entities and relationships), Views			10
Unit – 3: Structured Query Language			
Introduction, objectives, terminology, Data manipulationQuerying, sorting, grouping of data, logical and list operators, Single row numeric and string functions, Group functions, Joins, Sub-queries,Inserting, deleting and updating data. Data definition- Creating, altering and dropping database objects: tables, views, indexes, synonyms, constraints, users. Creating Procedures and Functions, Creating Database Triggers.			10
Unit – 4: Entity–Relationship Modelling and Logical Database Design			
Entity and Relationship Types, Attributes (single, composite and derived), Structural Constraints (1:1, 1:*, *:* relationships), Multiplicity, Cardinality and participation.			10
Unit – 5: Normalization			
Update anomalies, Functional dependencies, First, second, and third normal forms.			08

Text(T) / Reference(R) Books:	
T1	The Semantic Web, Berners-Lee, T., Hendler, J. and Lassila, Scientific American, 279, 2001.
T2	Extending the database relational model to capture more meaning, Codd, E.F., ACM Transactions on Database Systems (TODS), v.4 n.4, p.397-434
T3	Fundamentals of database systems, Elmasri, R., &Navathe, S., Pearson Addison Wesley.
R1	Database systems: a practical approach to design, implementation, and management, Connolly, T. &Begg, C, Addison-Wesley
W1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W2	https://www.edx.org/learn/databases
Course Outcomes: On completion of this course, students can	
CO1	Demonstrate understanding of the fundamental concepts of the relational database model and utilize database management systems to organize, store and retrieve data.
CO2	Make use of SQL (Structured Query Language) for database definition and manipulation, use of a conventional programming language to implement database connections.
CO3	Apply conceptual database modelling methods such as entity-relationship to model business requirements.

CO4	Make use of a step-by-step approach from conceptual and logical to a physical model to design databases.
CO5	Identify functional dependencies and apply normal forms to evaluate the quality of a relational database design.

APP TECHNOLOGIES			
Subject Code	21XXCSO60XC	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- To provide in depth knowledge and hands on experience in application development, the latest trends and features.

Unit -1: Android Programming Environment	**Hours**
Android programming environment, linking activities using intents, calling built-in applications using intents.	10
Unit -2:User Interface	
Creating the user interface programmatically, Listening for UI notifications, build basic views, build picker views, build list views, Using image views, Using menus with views, Saving and loading user preferences	**10**
Unit – 3:Data	
Persisting data to files, Creating and using databases, Study Session, sharing data in android, Using a content provider, Creating a content provider	**10**
Unit – 4: Networking	
SMS messaging, sending emails, Networking, displaying maps, Getting location data	**10**
Unit – 5: Services	
Creating your own services, communicating between a service and an Activity, Binding Activities to Services, A complete lab work for Android service development, Deploy APK files.	**08**

Text(T) / Reference(R) Books:	
T1	Beginning Android Application Development, Wei-Meng Lee, 1st Ed, Wiley Publishing.
T2	Android: A Programmers Guide, J. F. DiMarzio, McGraw Hill Education (India) Private Limited.1st Edition.

R1	Android for Programmers: An App-Driven Approach, Paul Deitel, 1st Edition, Pearson India
R2	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India Pvt Ltd
W1	https://www.coursera.org/browse/computer-science/mobile-and-web-development
W2	https://in.udacity.com/course/new-android-fundamentals--ud851

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate their understanding of the fundamentals of Android operating systems
CO2	Demonstrate their skills of using Android software development tools
CO3	Demonstrate their ability to develop software with reasonable complexity on mobile platform
CO4	Demonstrate their ability to deploy software to mobile devices
CO5	Demonstrate their ability to debug programs running on mobile devices

WEB TECHNOLOGIES			
Subject Code	21XXCSO70XA	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The main objective of this course is to provide basic knowledge of web design using HTML and CSS, client side scripting using JavaScript, handling web data using XML and server side scripting using PHP.

Unit-1: HTML	**Hours**
Introduction to HTML; Elements of HTML Document; HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formating: b, i, small, sup, sub; Spacing: Pre, Br; Formatting Text Phrases: span, strong, tt; Image element; Anchors; Lists: Ordered and Unordered and Definition; Tables; Frames; Forms: Form Elements, ID attributes, Class Attributes of HTML Elements; Meta Tag, Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags; HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events	**10**
Unit -2: Cascading Style Sheets	
Introduction; Cascading Style Sheets (CSS); CSS Syntax; Inserting CSS: Inline, Internal, External, ID and Class Selectors; Colors; Backgrounds; Borders; Text; Font; List; Table; CSS Box Model; Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin; Positioning: Relative, Float, Absolute; CSS3 Borders, Box Shadows, Text Effects and shadow; Basics of Responsive Web Designs; Media Queries, Introduction to Bootstrap	**10**
Unit –3: Client Side Scripting with JavaScript	
Structure of JavaScript Program; Variables and Data Types; Statements: Expression, Keyword, Block; Operators; Flow Controls, Looping, Functions; Popup Boxes: Alert, Confirm, Prompt; Objects and properties; Constructors; Arrays; Built-in Objects: Window, String, Number, Boolean, Date, Math, RegExp, Form, DOM; User Defined Objects; Event Handling and Form Validation, Error Handling, Handling Cookies, jQuery Syntax; jQuery Selectors, Events and Effects; Introduction to JSON	**10**
Unit -4: AJAX and XML	
Basics of AJAX; Introduction to XML and its Application; Syntax Rules for creating XML document; XML Elements; XML Attributes; XML Tree; XML Namespace; XML schema languages: Document Type Definition(DTD), XML Schema Definition (XSD); XSD Simple Types, XSD Attributes; XSD Complex Types; XML Style Sheets (XSLT), XQuery	**10**
Unit – 5: Server Side Scripting using PHP	

PHP Syntax, Variables, Data Types , Strings, Constants, Operators, Control structure, Functions, Array, Creating Class and Objects, PHP Forms, accessing Form Elements, Form Validation, Events, Cookies and Sessions, Working with PHP and MySQL, Connecting to Database, Creating, Selecting, Deleting, Updating Records in a table, Inserting Multiple Data, Introduction to CodeIgniter, Laravel, Wordpress etc.	**08**

Text(T) / Reference(R) Books:	
T1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013
T2	Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
T3	Introduction to JavaScript by Lindsay Bassett, 2015.
T4	Introduction to YAML: Demystifying YAML Data Serialization Format by Tarun Telang
T5	Full-Stack Vue.Js 2 and Laravel 5: Bring the frontend and backend together with Vue, Vuex, and Laravel
R1	Programming world wide web, Sebesta, Pearson
R2	An Introduction to web Design and Programming, Wang, Thomson
W1	https://www.edx.org/learn/web-development
W2	https://www.javatpoint.com/what-is-json
W3	https://www.javatpoint.com/yaml-scalars
W4	https://www.javatpoint.com/laravel-blade-template

Course Outcomes: On completion of this course, students can	
CO1	To develop a dynamic webpage by the use of HTML
CO2	To develop a dynamic webpage by the use of CSS
CO3	To develop a dynamic webpage by the use of JSON
CO4	To develop a dynamic webpage by the use of YML
CO5	Build web applications using PHP
CO6	To develop a dynamic webpage by the use of Laravel

ARTIFICIAL INTELLIGENCE			
Subject Code	21XXCSO70XB	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are

1. To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
2. To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs
3. To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

Unit -1: Introduction to artificial intelligence	**Hours**
Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.	**09**
Unit -2 : Problem solving: state-space search and control strategies	
Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction.	**10**
Unit – 3:Problem reduction, Game playing	
Problem Reduction: Introduction, Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem game playing, alpha-beta pruning, two-player perfect information games.	**10**
Unit – 4: Logic Concepts & Knowledge Representation Techniques	
Logic Concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic. Introduction to KR techniques, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.	**10**
Unit – 5: Expert systems and its applications	

Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems, blackboard systems, truth maintenance systems, application of expert systems, list of shells and tools.	**09**

Text(T) / Reference(R) Books:	
T1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
T2	Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA
T3	Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH
T4	Introduction to Artificial Intelligence, Patterson, PHI
R1	Artificial intelligence, structures and Strategies for Complex problem solving, - George F Lugar, 5thed, PEA
R2	Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
R3	Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier
R4	AI: A Modern Approach, Stuart Russell and Peter Norvig, Additional Readings: Marr, Bishop, occasionally others
W1	https://www.edx.org/learn/artificial-intelligence
W2	https://www.coursera.org/courses?query=artificial%20intelligence

Course Outcomes: On completion of this course, students can	
CO1	To introduce basic concepts of AI with its working principles.
CO2	To understand different kinds of heuristic search algorithms to get feasible solution for AI problems.
CO3	To understand problem reduction concepts using various problem reduction techniques. (Ex: Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem)
CO4	To understand various Knowledge Representation (KR) techniques
CO5	To understand different kinds of Expert Systems.

SOFTWARE ENGINEERING			
Subject Code	21XXCSO70XC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Software and Software Engineering	**Hours**
Introduction to Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths. **Process Models:** A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Product and Process, Process Terminology, Process Assessment and Improvement.	**10**
Unit -2: Software Requirements & Design	
Requirements Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification. **Overview of the Design Process:** How to Characterize a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design. Function-Oriented Software Design: Overview of SA/SD Methodology, Structured analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, overview of Object-Oriented design.	**12**
Unit – 3: Coding and Testing	
Coding: Coding Principles, Coding Standards, Code Review, Software Documentation **Testing**: Unit Testing, Integration Testing, System Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Testing Object-Oriented Programs, Some General Issues Associated with Testing.	**10**
Unit – 4: Software Reliability and Quality Management & CASE	
Software Reliability: Reliability, Statistical Testing, **Software Quality:** Software Quality Management System, ISO 9000, SEI Capability Maturity Model. **Computer Aided Software Engineering:** CASE and its Scope, CASE Environment, CASE Support in Software Life Cycle, Other Characteristics of CASE tools, Towards Second Generation CASE Tool, Architecture of a CASE Environment.	**10**
Unit – 5: Software Maintenance	
Software Maintenance: Maintenance Process Models, Maintenance Cost, Software Configuration Management. **Software Reuse:** what can be reused? Why Almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at organization Level.	**08**

Text(T) / Reference(R) Books:	
T1	Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHill International Edition.
T2	Fundamentals of Software Engineering, Third Edition, Rajib Mall, PHI.
T3	Software Engineering, Ian Sommerville, Ninth edition, Pearson education
T4	Software Engineering, Concepts and Practices, Ugrasen Suman, Cengage Learning
R1	Software Engineering A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
R2	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.

R3	Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press
R4	Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
R5	Software Engineering concepts, R. Fairley, TMH.
W1	https://www.edx.org/learn/software-engineering
W2	https://www.coursera.org/courses?query=software%20engineering

Course Outcomes:	
CO1	Define and develop software applications using different process models.
CO2	Describe the various design concepts to build real world software.
CO3	Interpret various coding and testing Techniques
CO4	Illustrate the Quality measures, Reliability Metrics and CASE Tools
CO5	Describe need of maintenance and reuse activities