REGULATIONS, COURSE STRUCTURE AND SYLLABUS

B.Tech.

for

Artificial Intelligence & Machine Learning

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 asemester.
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**: Lateral entry 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% weightage 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.

Mechanical Engineering (ME)

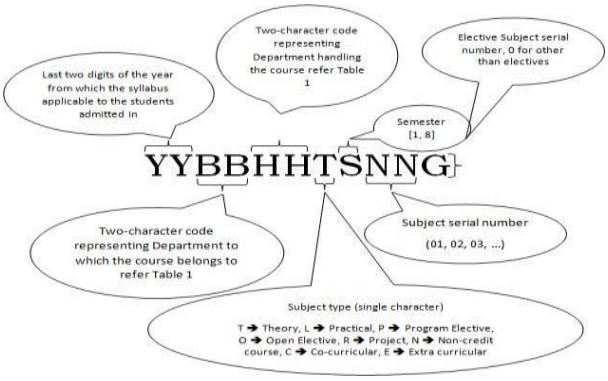


Figure 1: Course Numbering Scheme

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: Foundations of AI in 3rd semester for AI&ML with S. No 2 can be given as

Course Code: 21AMAMT3020

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

ry		No. of Credits								
		ECE/ECT		EEE		CSE/IT/CST		ME		
	AICTE	APSCHE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved	AIC
es al s	12	7	7.5	12	11	12	11	12	11	12
e	25	18	21	26	25	24	26	25	26	26
ng e	24	22.5	19.5	20	20	29	29.5	24	23	29
nal ses	48	55.5	55.5	53	62	49	48.5	48	55	47
nal e s	18	15	15	18	15	18	18	18	18	23
e	18	15	15	18	12	12	12	18	12	11
ork ar p	15	26.5	26.5	11	15	15	15	15	15	12
ry s	-		-	-	-	-	-	-	-	-
	160	160	160	158	160	159	160	160	160	16

Malpractice

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, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	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 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 the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the 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	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.

	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.	
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

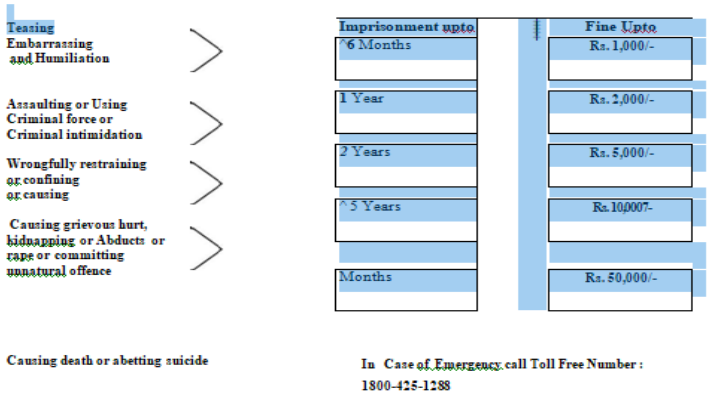
- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the 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.

COURSE STRUCTURE AND DETAILED SYLLABUS

for

B.Tech.

in

Artificial Intelligence and Machine Learning

Effective from the academic year 2021-22

Credit Distribution for B.Tech. AIML Program

	I-I	I-II	II-I	II-II	III-I	III-II	IV-I	IV-II	
Humanities and Social Sciences (HSS)	4.5				3.0		3.0		10.5
Basic Science courses (BS)	3.0	12.0	3.0	3.0					21.0
Engineering Science courses (ES)	12.0	7.5		4.5					24.0
Professional Core courses (PC)			16.5	12.0	9.0	13.5			51.0
Professional Elective Courses (PE)					3.0	3.0	9.0		15.0
Open elective courses (OE)					3.0	3.0	6.0		12.0
Skill Oriented Course (SOC)			2.0	2.0	2.0	2.0	2.0		10.0
Summer Internship (SI)					1.5		3.0		4.5
Project work								12	12.0
Mandatory Course (MC)	0	0	0	-	0	-	-	-	0
	19.5	19.5	21.5	21.5	21.5	21.5	23.0	12.0	**160**

Credit Comparison with AICTE and APSHE

S.No.	Category	No. of Credits		
		Suggested by AICTE	Suggested by APSCHE	Proposed
1	Humanities and Social Sciences (HSS)	12	7	10.5
2	Basic Science courses (BS)	25	18	21
3	Engineering Science courses (ES)	24	22.5	24
4	Professional Core courses (PC)	48	55.5	51
5	Professional Elective Courses (PE)	18	15	15
6	Open elective courses (OE)	18	15	12
7	Skill Oriented Course (SOC)	-	10	10
8	Summer Internship (SI)	15	4.5	4.5
9	Project work		12	12
10	Mandatory Course (MC)	-	-	-
	Total Credits	**160**	**160**	**160**

Course Structure for I B. Tech AIML Under the Regulations of SITE-21							
Semester -I							
S.No	Course Code	Subject Code	Course	L	T	P	C
1	HS	21CMMAT1010	Engineering Mathematics – I	3	0	0	3
2	BS	21AMPHT1020	Engineering Physics	3	0	0	3
3	ES	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	ES	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	ES	21AMMEL1050	Computer Aided Engineering Graphics	2	0	2	3
6	HS	21AMPHL1060	Engineering Physics Lab	0	0	3	1.5
7	ES	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
8	ES	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	MC	21CMMSN1090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
TOTAL				**16**	**0**	**11**	**19.5**

Course Structure for I B. Tech AIML Under the Regulations of SITE-21							
Semester -II							
S.No	Course Code	Subject Code	Course	L	T	P	C
1	BS	21CMEGT2010	Technical English	3	0	0	3
2	BS	21CMMAT2020	Engineering Mathematics - II	3	0	0	3
3	BS	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	ES	21CMCST2040	Python Programming	1	0	4	3
5	ES	21AMAMT2050	Data Structures	3	0	0	3
6	BS	21CMEGL2060	English Communication Skills Lab	0	0	3	1.5
7	BS	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	ES	21AMAML2080	DS Lab	0	0	3	1.5
9	MC	21CMCHN2090	Environmental Science	2	0	0	0
TOTAL				**16**	**0**	**11**	**19.5**

Proposed Course Structure for II B. Tech AIML Under the Regulations of SITE-21							
Semester -III							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	BS	21AMMAT3010	Probability and statistics	3	0	0	3
2	PC	21AMAMT3020	Foundations of Artificial Intelligence	3	0	0	3
3	PC	21AMAMT3030	Database Management Systems	3	0	0	3
4	PC	21AMAMT3040	Operating Systems	3	0	0	3
5	PC	21AMAMT3050	Analog & Digital Electronics	3	0	0	3
6	PC	21AMAMT3060	Artificial Intelligence Lab	0	0	3	1.5
7	PC	21AMAMT3070	Operating Systems Lab	0	0	3	1.5
8	PC	21AMAMT3080	Database Management Systems Lab	0	0	3	1.5
9	SOC	21AMAMC3090	Python for Data Science	1	0	2	2
10	MC	21AMBIN3100	MC: Biology for Engineers	3	0	0	0
			TOTAL				**21.5**

Sasi Institute of Technology & Engineering

Proposed Course Structure for II B.Tech AIML Under the Regulations of SITE-21							
Semester -IV							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	BS	21AMMAT4010	Discrete Mathematics	3	0	0	3
2	PC	21AMAMT4020	Introduction to Machine Learning	3	0	0	3
3	PC	21AMAMT4030	Design and Analysis of Algorithms	3	0	0	3
4	ES	21AMAMT4040	Java Programming	3	0	0	3
5	PC	21AMAMT4050	Optimization Techniques for AI	3	0	0	3
6	PC	21AMAML4060	Machine Learning Lab	0	0	3	1.5
7	PC	21AMAML4070	Design and Analysis of Algorithms Lab	0	0	3	1.5
8	ES	21AMAML4080	Java Programming Lab	0	0	3	1.5
9	SOC	21AMAMC4090	SOC: Fundamentals of Programming and Simulation using MATLAB for AI	1	0	2	2
			TOTAL				**21.5**
Internship 2 Months (Mandatory) during summer vacation							

Proposed Course Structure for III B.Tech AIML Under the Regulations of SITE-21							
Semester -V							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	HSS	21CMMST5010	Engineering Economics & Financial Management	3	0	0	3
2	PC	21AMAMT5020	Computer Networks	3	0	0	3
3	PC	21AMAMT5030	Software Engineering	3	0	0	3
4	PE	21AMAMT504X	Professional Elective-1	3	0	0	3
5	OE	21AMXXT5050	Open Elective-1	3	0	0	3
6	PC	21AMAML5060	Computer Networks Lab	0	0	3	1.5
7	PC	21AMAML5070	Software Engineering Lab	0	0	3	1.5
8	SOC	21CMAHS5080	Soft Skills & Aptitude builder I	1	0	2	2
9	MC	21AMAMN5090	MC: Intellectual Property Rights	2	0	0	0
10		21AMAMR5100	Summer Internship (Mandatory) after second year (to be evaluated during V semester	0	0	0	1.5
TOTAL							**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4

Professional Electives I

21AMAMT504A	Graph Theory
21AMAMT504B	Web Programming
21AMAMT504C	Computer Vision &Robotics
21AMAMT504D	Computer Graphics

Proposed Course Structure for III B.Tech AIML Under the Regulations of SITE-21							
Semester -VI							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	BS	21AMAMT6010	Deep learning	3	0	0	3
2	BS	21AMAMT6020	Compiler Design	3	0	0	3
3	PC	21AMAMT6030	Data Ware housing and Mining	3	0	0	3
4	PC	21AMAMT604X	Professional Elective -2	3	0	0	3
5	PC	21AMAMT6050	Open Elective -2	3	0	0	3
6	PC	21AMAMT6060	Deep learning Lab	0	0	3	1.5
7	PC	21AMAMT6070	Compiler Design Lab	0	0	3	1.5
8	PC	21AMAMT6080	Data Mining using Python Lab	0	0	3	1.5
9	SOC	21AMAMC6090	Soft Skills & Aptitude builder II	2	0	0	2
10	MC	21AMAMC6100	MC: Essence of Indian Traditional Knowledge	2	0	0	0
			TOTAL				**21.5**

Professional Electives II

21AMAMT604A	Software Testing Methodologies
21AMAMT604B	Information Retrieval Systems
21AMAMT604C	Cryptography and Network Security
21AMAMT604D	Pattern Recognition

Proposed Course Structure for IV B.Tech AIML Under the Regulations of SITE-21
Semester -VII

S.No	Subject Code	Course Code	Course	L	T	P	C
1	PC	21AMAMT701X	Professional Elective -3	3	0	0	3
2	PC	21AMAMT702X	Professional Elective -4	3	0	0	3
3	PC	21AMAMT703X	Professional Elective -5	3	0	0	3
4	PC	21AMXXT704X	Open Elective -3	3	0	0	3
5	PC	21AMXXT705X	Open Elective -4	3	0	0	3
6	HS	21AMAMT7060	Management Science	3	0	0	3
7	SOC	21AMAMT7070	Skill Oriented Course	1	0	2	2
		21AMAMT7080	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester	0	0	0	3
			TOTAL				**23**

Professional Electives III

21AMAMT701A	Internet of Things
21AMAMT701B	Reinforcement Learning
21AMAMT701C	DevOps
21AMAMT701D	Block Chain Technologies

Professional Electives IV

21AMAMT702A	Robotic Process Automation
21AMAMT702B	Natural Language Processing
21AMAMT702C	Big Data Analytics
21AMAMT702D	Soft Computing

Professional Electives V

21AMAMT703A	Cloud Computing
21AMAMT703B	Expert Systems
21AMAMT703C	Data Visualization
21AMAMT703D	Semantic Web

Proposed Course Structure for IV B.Tech AIML Under the Regulations of SITE-21
Semester -VIII

S.No	Subject Code	Course Code	Course	L	T	P	C
1	PC	21AMMAR5010	Project Work	3	0	0	12
			TOTAL				**12**

Open Electives: (Offered by AI&ML Department for other department students)

V SEM OPEN ELECTIVE -1 COURSES offered by AIML Department

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXAMO50XA	Artificial Intelligence	3	0	0	3
2.	21XXAMO50XB	Operating Systems Concepts	3	0	0	3

VI SEM OPEN ELECTIVE-2 COURSES offered by AIML Department

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXAMO60XA	Designing Database Management Systems	3	0	0	3
2.	21XXAMO60XB	R Programming	3	0	0	3

VII SEM OPEN ELECTIVE-3 COURSES offered by AIML Department

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXAMO70XA	Java Programming	3	0	0	3
2.	21XXAMO70XB	Introduction to Machine Learning	3	0	0	3

VII SEM OPEN ELECTIVE-4 COURSES offered by AIML Department

S. No	Subject Code	Name of the subject	L	T	P	CREDITS
1.	21XXAMO70XC	Internet of Things	3	0	0	3
2.	21XXAMO70XD	Optimization Techniques for AI	3	0	0	3

Minor Courses (For other Departments)

Note:

1. Any FOUR courses need to be studied from PART-A after their completion of II B. Tech I Sem.
2. From Part B, TWO, NPTEL courses of minimum EIGHT-week duration covering a total of 4 credits (offered by AI & ML Department) should be completed, Student can register at any time after the completion of II B.Tech. I Sem.
3. Students can pursue suggested MOOC Courses via NPTEL from II B. Tech II Sem and onwards, by prior information to the concern.

PART A

Minor Degree in "Artificial Intelligence and Machine Learning"						
S.No	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**
1	21YYAMMXXXX	Soft Computing	3	1	0	4
2	21YYAMMXXXX	Introduction to AI & Machine Learning	3	1	0	4
3	21YYAMMXXXX	Introduction to Data Science	3	1	0	4
4	21YYAMMXXXX	Deep Learning	3	1	0	4
5	21YYAMMXXXX	IOT	3	1	0	4
		Total Credits (Any 4 Courses)				16

PART B

S.No	**Name of the MOOC Course**	**Course Instructor**	**Links**
1	Artificial Intelligence: Search Methods for Problem solving	Prof. Deepak Khemani, IITM	https://onlinecourses.nptel.ac.in/noc22_cs67/preview
2	Introduction to Machine Learning	Prof. Balaraman Ravindran, IITM	https://onlinecourses.nptel.ac.in/noc22_cs73/preview
3	Data Science for Engineers	Prof. Ragunathan Rengasamy Prof. Shankar Narasimhan, IITM	https://onlinecourses.nptel.ac.in/noc22_cs72/preview
4	Machine Learning for Engineering and Science Applications	Dr. Balaji Srinivasan, IIT Madras	https://nptel.ac.in/courses/106106198

Course Structure and detailed syllabus for I B. Tech, AI&ML under regulations of SITE-21

Course Structure for I B. Tech AIML Under the Regulations of SITE-21							
Semester -I							
S.No	Course Code	Subject Code	Course	L	T	P	C
1	HS	21CMMAT1010	Engineering Mathematics – I	3	0	0	3
2	BS	21AMPHT1020	Engineering Physics	3	0	0	3
3	ES	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	ES	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	ES	21AMMEL1050	Computer Aided Engineering Graphics	2	0	2	3
6	HS	21AMPHL1060	Engineering Physics Lab	0	0	3	1.5
7	ES	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
8	ES	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	MC	21CMMSN1090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
TOTAL				**16**	**0**	**11**	**19.5**

Course Structure for I B. Tech AIML Under the Regulations of SITE-21							
Semester -II							
S.No	Course Code	Subject Code	Course	L	T	P	C
1	BS	21CMEGT2010	Technical English	3	0	0	3
2	BS	21CMMAT2020	Engineering Mathematics - II	3	0	0	3
3	BS	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	ES	21CMCST2040	Python Programming	1	0	4	3
5	ES	21AMAMT2050	Data Structures	3	0	0	3
6	BS	21CMEGL2060	English Communication Skills Lab	0	0	3	1.5
7	BS	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	ES	21AMAM2080	DS Lab	0	0	3	1.5
9	MC	21CMCHN2090	Environmental Science	2	0	0	0
TOTAL				**16**	**0**	**11**	**19.5**

ENGINEERING MATHEMATICS-I
(Calculus & Differential Equations)
(Syllabus for the academic year 2021 -2022)
Common to all the branches
Semester I/II

Subject Code	21CMMAT1010	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	
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.	**Hours – 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.	**Hours – 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.	**Hours – 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.	**Hours – 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.	**Hours – 12**

Course outcomes:

On completion of this course, students are able to

1. Solve the differential equations related to various engineering fields (L3)
2. Solve the differential equations of higher order related to various engineering fields (L3)
3. familiarize with functions of several variables which is useful in optimization (L3)
4. Solve the partial partial differential equations of first order (L3)
5. Apply double integration techniques in evaluating areas bounded by region (L3).

Question paper pattern:

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

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

Reference Books:

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

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

ENGINEERING PHYSICS
(Semiconductor Physics & Semiconductor Optoelectronics)
(Common for AI&ML, CSE, CST, EEE & IT)

Semester I/II

Subject Code	**21AMPHT1020** **21CTPHT1020** **21EEPHT2020** **21ITPHT2020**	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	
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.	**Hours – 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.	**Hours – 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.	**Hours –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.	**Hours – 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.	**Hours – 8**

COURSE OUTCOMES:

On completion of the course student will able to

1. **Understand** the theoretical view of electrical conductivity in metals using free electron theory and quantum mechanics.
2. **Estimate** the statistical calculation and the theoretical view of charge carrier's density in semiconductors.
3. **Generalization** of the light-matter interaction mechanisms.
4. **Describe** the basic laser physics and working of lasers.
5. **Illustrate** the construction and working function of LEDs.
6. **Analyze** the construction and working of photo diodes and solar cells.

QUESTION PAPER PATTERN:

1. It will have 5 questions with internal choice.
2. Each question carries 14 marks.

Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. S.O. Pillai, Solid state physics, New age publications.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons,
3. A Text Book of Engineering Physics- M.N.Avadhanulu, 11e , S.CHAND,

REFERENCE BOOKS:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning publications.
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
3. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
4. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
4	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Course	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ENGINEERING CHEMISTRY Semester I/II			
Subject Code	21CMCHT1030	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	
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.	**Hours –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.	**Hours –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.	**Hours –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.	**Hours –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.	**Hours –10**
COURSE OUTCOMES: On completion of the course student will be able to 1. Interpret the mechanism of corrosion 2. Summarize the problems faced in industries due to boiler troubles. 3. Recall the properties and applications of advanced materials. 4. Summarize the advantages of non-conventional energy resources and batteries. 5. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels. 6. Determine the strength of acid, base and some elements by volumetric and instrumental analysis.	

QUESTION PAPER PATTERN:

All questions should be answered, eachquestion carries 14 marks

TEXT BOOKS:

1. P.C. Jain and M. Jain "**Engineering Chemistry**", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "**A Textbook of Engineering Chemistry**", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.

REFERENCE BOOKS:

1. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
2. O.G. Palana, "**Engineering Chemistry**", Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) "**Preparation and characterization of materials**" Academic press, New York (latest edition)

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

PROGRAMMING FOR PROBLEM SOLVING Semester I/II			
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).	**8**

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.	
UNIT IV	
Pointers:(TB1:288-347) Understanding Pointers, Pointer Expressions, Pointer and Arrays, 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.	**12**
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 the suitable 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 Semester I/II			
Subject Code	21AMMEL1050	IA Marks	
Number of Lecture Hours/Week	2(L)+0(T)+2(P)	Exam Marks	
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	**Teaching 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-versa	10

COURSE OUTCOMES: On successful completion of this course, students will be able to

1. understand the BIS conventions of engineering drawing with basic concepts & draw engineering objects with appropriate lettering and dimensioning using various commands of AutoCAD
2. construct polygons, various types of Curves and scales used engineering application like maps, buildings, bridges
3. draw multi views of points, lines and planes by orthographic projection method
4. draw multi views of solids by orthographic projection method
5. convert the orthographic views into isometric views and vice versa by 2D-Commands in AutoCAD

Text Books

1. N.D. Bhatt & V.M. Panchal, Engineering Drawing, 48th edition, 2005, Charotar Publishing House, Gujarat
2. R.B.Choudary, Engineering Drawing with AutoCAD 2008, Anuradha Publishers

Reference Books

1. S. Trymbaka Murthy, Computer Aided Engineering Drawing, I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition 2006.
2. K.R. Gopalkrishna, Engineering Graphics, 32nd edition, 2005 Subash Publishers, Bangalore

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1):

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	2				3					2				3
2	2				3					2				3
3	2				3					2				3
4	2				3					2				3
5	2				3					2				3
Over all	2				3					2				3

ENGINEERING PHYSICS LAB **(Common for AI&ML, CSE, CST, EEE & IT)** Semester I/II			
Subject Code	**21AMPHL1060** **21CTPHL1060** **21ITPHL2060** **21EEEPHL2060**	IA Marks	15
Number of Practice Hours/Week	03L	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

1. **Compare** the theory and correlated with experiments.
2. **Design** experiments.
3. **Analyze** the experimental result.
4. **Apply** appropriate techniques to perform the experiments.
5. **Understand** the interaction of the light with semiconductor.

TEXT BOOKS:

1. "*Physics Laboratory Manual"* Prepared by Department of Physics, SITE.

REFERENCE BOOKS:

1. S. Balasubrahmanian, M.N. Srinivasan ''A Text book of Practical Physics''- S. Chand Publishers, 2017.
2. Advanced Practical Physics Vol 1& 2 SP Singh & M.S Chauhan Pragati Prakashan, Meerut

WEB SOURCES:

1. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

6. **Study** the characteristic curves of the optoelectronic semiconductor devices.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
4	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Course	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ENGINEERING CHEMISTRY LABORATORY

Semester I/II

(Approved syllabus for the academic year 2021 -22)

Subject Code	21CMCHL1070	IA Marks	15
Number of Practice Hours/Week	3L	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 Na_2CO_3 solution
2. Determination of alkalinity of a sample containing Na_2CO_3 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 conductometeric titration.
11. Determination of strength of weak acid using conductometeric 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.

PROGRAMMING FOR PROBLEM SOLVING LAB Semester I/II			
Subject Code	21CMCSL1080	IA Marks	15
Number of Lecture hours/Week	3L	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 SAS SASI

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.

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS (Common to all Branches) Semester I/II			
Subject Code	21CMCMSN1090	IA Marks	30
Number of Lecture Hours/Week	02	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.	**Hours – 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. .	**Hours – 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.	**Hours – 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.	**Hours –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.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

Text Books:

1. Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001

2. Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.

REFERENCE BOOKS:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. M. Govindarajan, S. Natarajan, V. S. Senthilkumar, **"Engineering Ethics",** Prentice – Hall of India Pvt. Ltd. New Delhi, 2004

3. Brij Kishore Sharma, **"Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.

4. Latest Publications of Indian Institute of Human Rights, New Delhi

TECHNICAL ENGLISH (Approved Syllabus for the Academic Year 2021-22 Semester II/II			
Subject Code	21CMEGT 1010/2010	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	10 hours

• Defining, Classifying • 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

COURSE OUTCOMES

On Completion of the course student will acquire

1. Ability to understand Scientific vocabulary and use them confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently

Question Paper Pattern

Section –A

1. 10 questions carrying one mark each
2. Five questions each from Units I and III

Section –B

1. 5 questions carrying 12 marks each (one compulsory question from non-detailed text)
2. Each question will have two or three sub questions covering all the units

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*

Unit	Title	Text books/Reference Books
I	Principles of Scientific Vocabulary	Text Book 1 Reference Book 5
II	Writing Skills	Text Book 1 Reference Book 2

		Reference Book 6
III	Common Errors in Writing	Text Book 1 Reference Book 3 Reference Book 4 Reference Book 7
IV	Nature and Style of Sensible Technical Writing	Text Book 1 Reference Book 1 Reference Book 2
V	Report writing and Letter writing	Text Book 1 Reference Book 1 Reference Book 2

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C111.1	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
C111.2	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
C111.3	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
C111.4	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
C111.5	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
C111.6	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
Overall Course										**2**					

ENGINEERING MATHEMATICS-II

(Linear algebra, Laplace transforms & Numerical Methods)

(Syllabus for the academic year 2021 -2022)

Common to all the branches

SEMESTER - II/II

Subject Code	21CMMAT2020	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	
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 Hours**
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 Hours**
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 Hours**
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 Hours**
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	**10 Hours**

value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge -Kutta method (second and fourth order).	

Course outcomes:

On completion of this course, students are able to,

1. Develop the use of matrix algebra techniques that is needed by engineers for practical applications and solve system of linear equations (L6)
2. Find the inverse and power of a matrix by Cayley-Hamilton theorem and reduce the Quadratic form (L3)
3. Solve initial value problems by using Laplace transforms (L3)
4. Find the solution of algebraic/ transcendental equations and also interpolate the functions(L3)
5. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3).

Question paper pattern:

5. Question paper consists of 10 questions.
6. Each full question carrying 14 marks.
7. Each full question will have sub question covering all topics under a unit.
8. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.
3. B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006

Reference Books:

1. Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, "Engineering Mathematics, Volume II" Scitech Publications, 2017.
2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata McGraw Hill Education, 4th Edition, 2018
3. 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.
4. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press, 1st Edition 2014.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Basic Electrical Engineering
(Proposed syllabus for the academic year 2021-22)
Common for ECE, CSE, IT/ CE, EEE, ME, ECT, CST, AI & ML
SEMESTER II/II

Subject Code	**21CMEET2030**	**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	
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)	**Hours – 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,	**Hours – 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.	**Hours – 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.	**Hours – 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.	**Hours – 10**

Course Outcomes: The student should be able 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.

Text Books:

i. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group.

ii. Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand and Company Limited.

Reference Books:

i. Theory and Performance of Electrical Machines by J.B. Gupta, S.K.Kataria & Sons.

ii. A Textbook of Electrical Technology – Volume II: AC & DC Machines by B.L.Theraja & A.K. Theraja, S.Chand and Company Limited.

iii. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.

iv. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications

v. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.

vi. Electrical Technology by Surinder Pal Bali, Pearson Publications.

COURSE-OUTCOMES-TO-PROGRAM-OUTCOMES-MAPPING:

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	1												
CO2	2	2	1												
CO3	2	2	1												
CO4	2	2	1												
CO5	2	2	1												
CO6	2	2	1												
Overall Course	**2**	**2**	**1**												

PYTHON PROGRAMMING Semester II/II			
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 and Character 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.	**12**
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.	**10**
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.	**8**
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.	**8**

Course Outcomes: After completion of this course student will able to learn	
CO1	Explain the fundamental 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.

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

DATA STRUCTURES Semester II/II			
Subject Code	21AMAMT2050	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),	**8**

Applications- Minimum Spanning Tree Using Prims &Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.	

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.

English & Communication Skills Lab

(Approved Syllabus for the Academic Year 2021 -2022)

Semester II/II

Subject Code	21CMEGL2060	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 to acquire 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
(Proposed syllabus for the academic year 2021-22)
SEMESTER II
Common for ECE, CSE, IT/ CE, EEE, ME, ECT, CST, AI & ML

Subject Code	**21CMEEL2070**	**IA Marks**	**15**
Number of Lecture Hours/Week	**3P**	**Exam Marks**	**35**
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's laws, 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's laws.
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 OUTCOM

On completion of the course student will be able to:

1. Verify the Kirchoff's laws.
2. Verify network theorems for a given circuit.
3. Control the speed of DC motor.
4. Analyze performance of single-phase induction motor
5. Analyze performance of three phase induction motor.
6. Identify different types of earthings

COURSE-OUTCOMES-TO-PROGRAM-OUTCOMES-MAPPING:

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1			2												
CO2			2												
CO3			2												
CO4			2												
CO5			2												
CO6			2												
Overall Course			**2**												

Data Structures Lab Semester II			
Subject Code	21AMAML2080	IA Marks	30
Number of Lecture hours/Week	3	Exam Marks	70
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	Making use of basic data structures such as arrays and linked list to solve problems.
CO2	Demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
CO3	Solve various searching and sorting problems.

ENVIRONMENTAL SCIENCE Semester II			
Subject Code	21CMCHN2090	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	
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.	**Hours – 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.	**Hours –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 of biodiversity - Threats to biodiversity: habitat loss - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**Hours –8**
Module – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution	**Hours –6**

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.	
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 .	**Hours –6**
COURSE OUTCOMES: On completion of the course student will be able to 1. Obtain knowledge on global warming & climate change - Acid rains, ozone layer depletion. 2. Preserve several natural resources 3. Summarize the concept of ecosystem 4. Control different types of pollution 5. Understand social issues and environmental legislation	
QUESTION PAPER PATTERN: All questions should be answered, each question carries 14 marks	
TEXT BOOKS: 1. E. Bharucha (2003), "Environmental Studies", University Publishing Company, New Delhi. 2. J.G. Henry and G.W. Heinke (2004), "Environmental Science and Engineering", Second Edition, Prentice Hall of India, New Delhi. 3. G.M. Masters (2004)" Introduction to Environmental Engineering and Science", Second Edition, Prentice Hall of India, New Delhi	
REFERENCE BOOKS: 1. Text Book of Environmental Studies by Deeksha Dave & P. Udaya Bhaskar, Cengage Learning. 2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada. 3. Environmental Studies, P.N. Palaniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.	

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	2	3	2	-	-	-	2	-	-	-	-	-	-	-	-

Course Structure and detailed syllabus of II B. Tech, I semester, AI&ML, under the regulations of SITE-21

Course Structure for II B. Tech, AIML Under the Regulations of SITE-21							
Semester -III							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	BS	21AMMAT3010	Probability and statistics	3	0	0	3
2	PC	21AMAMT3020	Foundations of Artificial Intelligence	3	0	0	3
3	PC	21AMAMT3030	Database Management Systems	3	0	0	3
4	PC	21AMAMT3040	Operating Systems	3	0	0	3
5	PC	21AMAMT3050	Analog & Digital Electronics	3	0	0	3
6	PC	21AMAML3060	Artificial Intelligence Lab	0	0	3	1.5
7	PC	21AMAML3070	Operating Systems Lab	0	0	3	1.5
8	PC	21AMAML3080	Database Management Systems Lab	0	0	3	1.5
9	SOC	21AMASC3090	Python for Data Science	1	0	2	2
10	MC	21CMBIN3100	MC: Biology for Engineers	3	0	0	0
			TOTAL				**21.5**

PROBABILITY AND STATISTICS
(AI & ML)
SEMESTER III

Subject Code	21AMAMT3010	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite	Data Structures		**Credits -3.0**

Course Objectives: Students are expected to learn

- concepts of data science and to fit a linear or nonlinear curve using method of least squares
- the concept of a random variable, generating functions and their properties
- Analyze various statistical measures of a few discrete distributions the continuous distribution suitable for the given data from its moments
- Analyze various statistical measures of a few continuous distributions
- Develop a framework for testing of hypothesis in giving inferences about Population Parameters.
- Study Queuing models and their Characteristics.

Unit-1	**Hours**
Descriptive statistics and methods for data science: Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variables: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability (spread or variance), Skewness, Kurtosis **Correlation:** Definition, Karl Pearson's Coefficient of Correlation, Limits for correlation coefficient, Rank Correlation, Spearman's formula for rank correlation coefficient (without proofs). **Regression Analysis:** Regression Lines, Regression Coefficients and their properties (without proofs). **Curve fitting:** Method of least Squares, fitting of a Straight line, Fitting of a Parabola	10
Unit-2	
Random Variables and Probability functions: Review of basic concepts of Probability (no questions will be set on review). Definition of a random variable, Distribution function, Properties of Distribution Function, 20 Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function, Continuous Distribution Function. Introduction to Joint random variable and its Probability functions. **Mathematical Expectation:** Mathematical Expectation of a Random Variable, Expected Value of function of a Random Variable, Addition Theorem and Multiplication Theorem of Expectation (without proofs), Statistical Measures like Mean, Variance, Moments and Covariance in terms of Expectations. **Generating functions:** Moment generating Function, Characteristic Function and Probability generating Function of a Random Variable.	10
Unit-3	
Discrete and Continuous Distributions:	10

Discrete Distributions: Binomial distribution and Poisson distribution - Definition, Mean, Variance, moments, m.g.f., Characteristic function, p.g.f., Fitting of distributions. **Continuous Distributions:** Normal Distribution - Definition, Standard Normal Variate, Mean, Variance, m.g.f., Characteristic function, Applications of Normal Distribution, Importance of Normal distribution. Exponential Distribution, Definition, Mean, Variance and Memory less property of Exponential distribution	
Unit-4	
Sampling theory and Testing of Hypothesis: **Sampling Theory:** Sample, population, statistic, parameter, Sampling distribution, standard error, point and interval estimation. Testing of Hypothesis: Formulation of Null hypothesis, Alternative hypothesis, Critical region, level of significance, Errors in sampling- Type-I-error, Type-II-error, One-tailed and Two-tailed tests Degrees of freedom. **Large Sample Theory:** Test of significance of single sample proportion, Test of significance for difference of proportions. **Small Sample Theory:** Student's-t-distribution: definition, t-test for single mean, t-test for difference of means, Paired t-test for difference of means. F-distribution: definition, F-test for equality of two population variances. Chi-square distribution: definition, Chi-square test for goodness of fit.	10
Unit-5	
Queuing Theory: Queue description, Birth and Death Process, Distribution of Inter-arrival times, Distribution of service times, Kendall's representation of a queuing model, Operating characteristics of a queuing model, steady-state solutions of {M/M/1: ∞/FCFS} Model and {M/M/1; N/FCFS} Model.	10

Course outcomes:

On completion of the course student will be able to:

- Understand the concepts of data science and fit a best suitable curve for the given data.
- Identify the random variable as discrete/continuous and analyze it.
- Predict the discrete distribution suitable for the given data from its moments.
- Predict the continuous distribution suitable for the given data from its moments
- Decide the test applicable for giving inference about Population Parameter based on Sample statistic.

Text Books:

1. Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor, Sultan Chand & Sons Publishers.
2. Probability, Statistics and Random Processes by T.Veerarajan, Tata Mc Graw Hill Pub.
3. Operations Research by S D Sharma, Khanna publications.

Reference Books:

1. Probability & Statistics with Reliability, Queueing and Computer Applications by Kishore.S.Trivedi,Prentice Hall of India, 1999.
2. Probability and statistics for Engineers, Miller and Freund, 7th edition, Prentice-Hall India.

Foundations of Artificial Intelligence (AI & ML) SEMESTER III			
Subject Code	21AMAMT3020	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite	Data Structures		**Credits -3.0**

Course objectives:

Enable the students to

- Gain a historical perspective of AI and characteristics of intelligent agents.
- Become familiar with basic principles of AI toward problem solving.
- Know approaches of inference, perception, knowledge representation, and learning.

Unit-1	**Hours**
Introduction: Foundations of AI , History of AI, I AI problems, Agents and Environments, intelligent agent -Types of agents , Structure , Problem solving agents, AI programming languages , Introduction to LISP and PROLOG, AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI.	10
Unit-2	
Searching Techniques: Problem Spaces, Uninformed search strategies, Breadth first search, Uniform cost search, Depth first search, Depth limited search, Bidirectional search, Searching with partial Information, Informed search Strategies , A* Heuristic function, Hill Climbing, Simulated Annealing, Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning.	10
Unit-3	
Knowledge Representation : Knowledge based agent, The Wumpus world environment, Propositional logic ,Inference rules , First-order logic : Syntax and semantics , Situation calculus - Building a knowledge base , Electronic circuit domain , Ontological Engineering, Forward and backward chaining , Resolution, Truth maintenance system.	10
Unit-4	
Planning and Uncertainty: Planning, Representation of planning, Partial order planning, logic based planning, Linear planning using a goal stack, Means-ends analysis, Non-linear planning strategies, learning plans Planning and acting in real world ,Acting under uncertainty, Bayes rules, Semantics of Belief networks , Inference in Belief networks.	10
Unit-5	
Learning: Learning from observation, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Winston's Learning Program Inductive learning, Decision trees, Explanation based learning - Statistical Learning methods, Case Study: Chat bot System.	10

Course outcomes:

On completion of the course student will be able to:

1. Enumerate the history and foundations of Artificial Intelligence.
2. Understand and implement different search strategies
3. Represent a problem using first order logic and propositional logic.
4. Apply the Baye's rule to solve the problem
5. Analyze the different learning systems to solve a given problem.

Text Books:

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.

3. Artificial intelligence, structures and Strategies for Complex problem solving, George F Lugar, 5th edition, PEA.

Reference Books:

1. M.Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1st Edition, 2008.
2. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", 2nd Edition, Cambridge University Press, 2010.
3. Wolfgang Ertel, "Introduction to Artificial Intelligence", 1st Edition, Springer, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2. https://www.cs.cornell.edu/courses/cs4700/2013fa/slides/CS4700-Intro_part1_v5.pdf

DATABASE MANAGEMENT SYSTEMS (AI & ML) SEMESTER III			
Subject Code	21AMAMT3030	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite	Data Structures		**Credits -3.0**

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 bycovering 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, Database 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, KeyConstraints, 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	10

dependency, normal forms basedon 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).	
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, twophase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management	10

Course outcomes:

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

1. Understand the basic elements of a relational database management system.
2. Draw entity relationship and convert entity relationship diagrams into RDBMS
3. Create, maintain, and manipulate a relational database using SQL.
4. Designs and applies normalization techniques for logical schema model.
5. Solves concurrent issues and problems through locking mechanism.

Text Books:

1. Introduction to Database Systems, CJ Date, Pearson
2. Database Management Systems, 3rd Edition, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill.
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson
4. Database Management Systems,6/e Ramez Elmasri, Shamkant B. Navathe, PEA

1. Data base Systems design, Implementation, and Management, 7th Edition, Peter Rob & Carlos Coronel
2. Database System Concepts, 5th edition, Silberschatz, Korth, TMH
3. The Database Book Principles & Practice Using Oracle/MySQL, Narain Gehani, University Press.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2. https://www.cs.cornell.edu/courses/cs4700/2013fa/slides/CS4700-Intro_part1_v5.pdf

OPERATING SYSTEMS			
Subject Code	21AMAMT3040	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: 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.	**08**
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.	**12**

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	Design various Scheduling algorithms, Apply the principles of concurrency.
CO2	Design deadlock, prevention and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Design and Implement a prototype file system, Perform administrative tasks on Linux Servers.
CO5	Introduction to Android Operating System Internals.

ANALOG AND DIGITAL ELECTRONICS SEMESTER III			
Subject Code	21AMAMT3050	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	
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.	**Hours –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	**Hours –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.	**Hours – 9**
Unit – 4	
Combinational Logic Circuits: The Map Method, Don't-Care Conditions, Binary Adder-Subtractor, Decimal Adder, Magnitude Comparator, Decoders, Encoders, Multiplexers.	**Hours – 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.	**Hours – 9**
Total	**50**

Course outcomes:

On completion of the course student will be able to:

1. Understand the characteristics and utilization of various components.
2. Understand and analyze the BJT and MOSFET
3. Apply the Boolean algebra to optimize the logic functions using K-maps and Understand the field effect transistors
4. To design and analyze combinational logic circuits
5. To design and analyze sequential logic circuits.

Text Books:

1. A.S. Sedra&K.C.Smith, Microelectronics Circuits, Oxford University Press, 3rd edition, 1997.
2. Morris Mano, Michael D Ciletti , "Digital Design" , 4thEdition, PEA
3. R.P. Jain, "Modern Digital Electronics", Tata McGraw-Hill, 4th edition, 2008.

Reference Books:

1. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons
2. J.F. Wakerly, "Digital Design Principles", 4th edition, Pearson Education, 2005

Artificial Intelligence Laboratory (AI & ML) SEMESTER III			
Subject Code	21AMAML3060	Internal Marks	15
Number of Lecture Hours/Week	3	External Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Pre-requisite	Data Structures	**Credits -3.0**	

Course objectives:

Enable the students to

- Study the concepts of Artificial Intelligence
- Learn the methods of solving problems using Artificial Intelligence
- Introduce the concepts of machine learning

List of Experiments

1. Study of Prolog.
2. Write simple facts for the following:

   a. Ram likes mango. b. Seema is a girl. c. Bill likes Cindy. d. Rose is red. e. John owns gold.
3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4. Write a program to solve the Monkey Banana problem.
5. Write a program in turbo prolog for medical diagnosis and show the advantage and disadvantages of green and red cuts.
6. Write a program to implement factorial, Fibonacci of a given number.
7. Write a program to solve the 4-Queen problem.
8. Write a program to solve the traveling salesman problems.
9. Write a program to solve the water jug problem using PROLOG.
10. Implementation of A* using PROLOG

Course Outcomes: At the end of the practical course the student will be able to:

1. Identify problems that are amenable to solution by AI methods.
2. Identify appropriate AI methods to solve given problem.
3. Use language framework of different AI methods for solving problems.
4. Implement basic AI algorithms.
5. Design and carry out an empirical evaluation of different algorithms on the Problem formalization, and state the conclusions that the evaluation Supports.

Python for Data Science (AI & ML) SEMESTER III			
Subject Code	21AMAMC3090	Internal Marks	15
Number of Lecture Hours/Week	1L +2P	External Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Pre-requisite			**Credits -2.0**

Course objectives: On successful completion of this course, Student will be able to:
1. Understand the significance of data science tools.
2. Apply statistical methods to implement functionalities in Numpy, Scipy, Pandas packages.
3. Analyze the significance of Inferential Statistics.
4. Apply Exploratory Data Analytical Techniques to visualize parameters.
5. Understand the concepts of machine learning concepts to analyze Data.

List of Experiments

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions
5. Averages
6. Variability
7. Normal curves
8. Correlation and scatter plots
9. Correlation coefficient
10. Regression

Course outcomes:
1. Describe common Excel functionality and features used for data science
2. Analyze and construct the data Visualization
3. Configure the programming environment
4. Analyze real time data set
5. Implement Pivot tables and LOOKUP functions

1. Text Books: 1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2012.
2. 2. Cathy O’Neil and Rachel Schutt, “Doing Data Science”, O'Reilly, 2015.
3. 3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed

BIOLOGY FOR ENGINEERS Semester III			
Subject Code	**21AMBIN3100**	**IA Marks**	**30**
Number of Lecture Hours/Week	**3**	**Exam Marks**	**70**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Course Type: MC, Credits – 00

Course Objectives: Students should be able to:

1. Convey that Biology is as important as scientific discipline as Mathematics, Physics and Chemistry
2. Convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
3. Convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
4. Convey that all forms of life have the same building blocks and yet the manifestations areas diverse as one can imagine
5. Convey that without catalysis life would not have existed on earth
6. molecular basis of coding and decoding genetic information is universal
7. Analyse biological processes at the reduction its level
8. The fundamental principles of energy transactions are the same in physical and biological world.

Unit -1 Introduction	**Teaching 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.	**Hours – 8**
Unit -2 Classification	
Hierarchy of life forms at phenomenological level- classification based on (a) cellularity - Unicellular or multicellular (b) ultra structure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophy, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic 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	**Hours – 8**
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. **Molecules of life:** Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	**Hours–12**

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. **Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	**Hours–12**
Unit – 5 Microbiology & Metabolism	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoinc reactions. Concept of Keq and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge **Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	**Hours–10**

Course outcomes: Students will be able to

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classifyenzymesanddistinguishbetweendifferentmechanismsofenzymeaction.
6. Convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Question paper pattern:

Section A:

1. This section contains ten one- or two-line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12marks.
3. Each full question comprises sub question covering all topics under a unit.

TEXT BOOKS

1. 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 EducationLtd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

REFERENCES

1. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

Course Structure and detailed syllabus of II B. Tech, II semester, AI&ML, under the regulations of SITE-21

Course Structure for II B. Tech, II Semester, AIML, Under the Regulations of SITE-21							
Semester -IV							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	BS	21AMMAT4010	Discrete Mathematics	3	0	0	3
2	PC	21AMAMT4020	Introduction to Machine Learning	3	0	0	3
3	PC	21AMAMT4030	Design and Analysis of Algorithms	3	0	0	3
4	ES	21AMAMT4040	Java Programming	3	0	0	3
5	PC	21AMAMT4050	Optimization Techniques for AI	3	0	0	3
6	PC	21AMAML4060	Machine Learning Lab	0	0	3	1.5
7	PC	21AMAML4070	Design and Analysis of Algorithms Lab	0	0	3	1.5
8	ES	21AMAML4080	Java Programming Lab	0	0	3	1.5
9	SOC	21AMAMC4090	SOC: Fundamentals of Programming and Simulation using MATLAB	1	0	2	2
			TOTAL				**21.5**
Internship 2 Months (Mandatory) during summer vacation							

DISCRETE MATHEMATICS (Syllabus for the academic year 2022 -2023) SEMESTER - II/II			
Subject Code	21AMMAT4010	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	
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.	**Hours –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**.**	**Hours – 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.	**Hours – 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.	**Hours – 08**
Unit – 5	
Graph Theory (TB2: Page Number 641 to 735) Introduction to Graphs, Sub graphs, Graph Representations, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs.	**Hours – 10**

Course outcomes:

At the end of the course student will be able to

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

Question paper pattern:

9. Question paper consists of 10 questions.
10. Each full question carrying 14 marks.
11. Each full question will have sub question covering all topics under a unit.
12. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and R. Manohar, Tata McGraw Hill.
2) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

Reference Books:

1) Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2) Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rdEdition, Tata McGraw Hill.

e-Resources:

https://nptel.ac.in/courses/106/106/106106094/

Introduction to Machine Learning (AI & ML) SEMESTER IV			
Subject Code	21AMAMT4020	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite	Data Structures	**Credits -3.0**	

Course objectives:

Enable the students to

- Understand the concept of machine learning
- Distinguish machine learning techniques such as decision tree learning, Bayesian learning etc.
- Understand computational learning theory.
- Study the pattern comparison techniques.

Unit-1	**Hours**
Introduction: Machine Learning, Definition, datasets, Feature sets, Dataset division: test, train and validation sets, cross validation. Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.	10
Unit-2	
Evaluation Hypotheses: Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms, concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm.	10
Unit-3	
Supervised learning: Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve.	10
Unit-4	
Unsupervised learning: Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.	10
Unit-5	
Decision Tree Learning: Representation, appropriate problems, basic decision tree learning algorithm, hypothesis space search, inductive bias, issues in decision tree learning. **Bayesian learning**: Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, and the EM algorithm.	10

Course outcomes:

On completion of the course student will be able to:

- Understand the Machine learning principles and data sets
- Analyze different Machine learning algorithms
- Analyze the supervised learning methods
- Analyze unsupervised learning methods
- Understand and Analyze the Decision Tree learning, Bayesian learning

Text Books: 4. Machine Learning – Tom M. Mitchell, - MGH 5. Applied Machine Learning, M.Gopal, Mc Graw Hill Education
Reference Books: 3. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis 4. Machine Learning, The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge press 5. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
Web References: 1. https://www.deeplearning.ai/machine-learningyearning/ 2. https://nptel.ac.in/courses/106106139

<table>
<tr><td colspan="4">DESIGN AND ANALYSIS OF ALGORITHMS
SEMESTER IV</td></tr>
<tr><td>Subject Code</td><td>21AMAMT4030</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits: 03</td></tr>
<tr><td colspan="4">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 anddata structures.
• Apply important algorithmic design paradigms andmethods of analysis.
• Synthesize efficient algorithms in common engineering design situations</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Elements of Dynamic Programming:
Optimal sub structure, overlapping sub problems, Reconstructing an optimal solution, Memorization. Example Problems:
Longest common Subsequence, Optimal Binary search trees, String Editing, 0/1 Knap Sack Problem,The Traveling Salesperson Problem,
Elements of Greedy Strategy:
Concept, Greedy – Choice property, Optimal sub structure, Greedy vs Dynamic programming, Example Problems: Huffman codes, Knap Sack Problems, Tree Vertex Splitting, Job Sequencingwith Dead Lines.</td><td>11</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Back Tracking:
Concept, State Space, Solution Space, Tree Organization of State Space and Solution Space, illustration using 4-Queens Problem, Sum of Subsets Problems, Example Problems:
8-Queens Problem, Sum of Sub sets, Graph Coloring, Hamiltonian Cycles, 0/1 Knap Sack Problem,
Branch and Bound:
Least Cost (LC) Search, 15-Puzzle Example, ControlAbstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC-Branch-and -Bound,
Example Problems:
0/1 Knap Sack Problem, Traveling Sales Person Problem</td><td>09</td></tr>
<tr><td colspan="4">Unit - 3</td></tr>
</table>

Elementary Graph Algorithms: Concepts, Representation of Graphs, Breadth First Search, Depth First Search, Topological sort, Strongly Connected Components, Biconnected Components, Articulation Points **Minimum Spanning Trees:** Growing Minimum Spanning Tree, Kruskal`s Algorithm, Prim`s Algorithms, **Single Source Shortest Paths:** Shortest Path, Edge Weights, Variants of Shortest Path Problems, Optimal Sub Structure of Shortest Path, Negative Edge Weights, Cycles, Representing Shortest Paths, Relaxation, Properties of Shortest path and Relaxation, **All-Pairs Shortest Paths:** Concept, Shortest Path and Matrix Multiplication, **Shortest Path Algorithms:** Bellman Ford Algorithm, Dijkstra`s Algorithm, Floyd- Warshall Algorithm.	**11**
Unit – 4	
Computability of Algorithms: Tractable and Intractable, Computability Classes – P, NP, NPC, NPH, showing problems to be NPC, Reductions, **Tractable Problems:** Supporting arguments, Abstract Problems, Encodings, **Polynomial Time Verification:** Hamiltonian Cycles, Verification Algorithms,Complexity class NP, **NP Completeness:** Reducibility, NP Completeness, Circuit Satisfiability, Circuit Satisfiability, **NP Completeness Proof:** Formula Satisfiability, 3CNF Satisfiability, **NP-Complete Problems:** Clique, Vertex-cover, Hamiltonian Cycle, Traveling-Salesman Problem, Subset Sum Problem	**10**
Unit - 5	
Approximation Algorithms: Roles and functions, Components,Structure,Operations, Load Balancing Problem, CenterSelection Problem, Set Cover, Greedy Heuristics, **Randomized Algorithms:** Contention Resolution, Global Minimum Cut, Random Variables and Their Expectations, A Randomized Approximation Algorithm for MAX 3-SAT, Randomized Divide and Conquer: Median Finding and Quick Sort.	**09**
COURSE OUTCOMES: On completion of the course student will able to: 1. Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness ofalgorithms. 2. Describe the greedy paradigm and explain when an	

algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

3. 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.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. For a given problems of dynamic-programming an develop the dynamic programming algorithms andanalyze it to determine its computational complexity.For a given model engineering problem model it is using
graph and write the corresponding algorithm to solve theproblems.

Text Books:

1. Interdiction to Algorithms, Third Edition, Thomas H Coremen,Charles E.Leiserson, Clifford Stein, MIT Press/McGraw-Hill.
2. Computer Algorithms, Ellis Horowitz, Sartaj Sahni, SRajasekaran, Computer Science Press
3. Algorithm Design, First Edition, JON Kleinberg, EVATardos, Pearson Addison Wesley

Reference Books:

1. Algorithm Design: Foundation, analysis, and Internet Examples, First Edition, John Wiley & sons.

Web References:

1. https://www.coursera.org/specializations/algorithms
2. https://swayam.gov.in/course/4417-design-and- analysis-of-algorithms

JAVA PROGRAMMING SEMESTER IV			
Subject Code	21AMAMT4040	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable the students to:

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development.
- Have the ability to write a computer program to solve specified problems.

Unit -1: Introduction to OOP	**Hours**
Introduction to Object Oriented Programming, Principles of Object-Oriented Languages, Procedural languages Vs OOP, History and Evolution of Java, Java Virtual Machine, Java Features, Program Structure, Variables, Primitive Data Types, Variables, Type Conversion and Casting, Operators, Control Statements, Arrays, String.	**08**
Unit -2 : Introducing Classes, Methods and Inheritance	
Class Fundamentals, Declaring Objects, Reference Variables, Methods, Constructors, this keyword, Garbage Collection, finalize() method. Overloading Methods and Constructors, usage of static and final keywords, Command line arguments. Inheritance basics, using super, method overriding, dynamic method dispatch, abstract classes.	**10**
Unit – 3: Packages, Interfaces, Exception Handling and I/O	
Packages, Access Protection, Interfaces, Exception Handling, Exception types, built in exceptions, user defined exceptions, using try, catch, throw, throws, finally, chained exceptions, assertions I/O Basics, reading console input and writing console output, Reading and Writing Files	**10**
Unit – 4: Multi-Threading and java util Package	
Java Thread Model, creating a thread, Thread priorities, Synchronization, Inter Thread Communication, collections overview, collection interfaces, collection classes, iterator, maps, comparators.	**10**
Unit – 5: Introducing GUI Programming with JavaFX	
JavaFX Basic Concepts, JavaFX Application Skeleton, JavaFX, Control: Label, Button, Image, Image View, Radio Button, Checkbox, List View, Combo Box, Text Field, Scroll Pane, JavaFx Menus, JavaFX Event Handling	**12**

COURSE OUTCOMES:

On completion of the course student will able to:

1. Design classes, interfaces and packages.
2. Demonstrate inheritance, polymorphism, encapsulation.
3. Demonstrate user defined exceptions.
4. Create Threads to parallelize operations.
5. Create rich user-interface applications using modern APIJavaFX.

Text Books:

1. The complete Reference Java, 9th edition, Herbert Scheldt, TMH.
2. Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford.

Reference Books:

1. JAVA Programming, K Rajkumar, Pearson
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming Through Java, P. Radha Krishna, Universities Press.

Web References:

1. https://www.edx.org/learn/java
2. https://onlineitguru.com/core-java-online-training- placement.html

OPTIMIZATION TECHNIQUES FOR AI
SEMESTER-IV

Subject Code	**21AMAMT4050**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**53**	**Exam Hours**	**03**

Credits -03

Course Objectives:

This course will enable student to:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
5. To introduce evolutionary programming techniques.

Unit-1	
Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.	**Hours – 10**
Unit – 2	**Hours – 10**
Classical Optimization Techniques Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints.Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn, Tucker conditions.	
Unit – 3	**Hours –10**
Linear Programming Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm, Duality in Linear Programming, Dual Simplex method.	
Unit – 4	**Hours – 10**
Nonlinear Programming: Unconstrained cases, One, dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method and steepest descent method. **Constrained cases,** Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods.	
Unit – 5	

Introduction to Evolutionary Methods: Evolutionary programming methods, Introduction to Genetic Algorithms (GA)– Control parameters, Number of generation, population size, selection, reproduction, crossover and mutation, Operator selection criteria, Simple mapping of objective function to fitness function, constraints, Genetic algorithm steps, Stopping criteria – Simple examples.	**Hours – 13**

Course outcomes:

On completion of the course student will be able to:

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
4. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.
5. Able to apply Genetic algorithms for solving Engineering problems.

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Soft Computing with Matlab Programming by N.P.Padhy&S.P.Simson, Oxford University Press – 2015

Reference Books:

1. "Optimization methods in operations Research and Systems Analysis" by K.V.Mital and C.Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Genetic Algorithms in search, optimization, and Machine Learning by David E.Goldberg,ISBN:978-81-7758-829-3, Pearsonby Dorling Kindersley (India) Pvt. Ltd.
3. "Operations Research: An Introduction" by H.A.Taha, PHI pvt. Ltd., 6th edition.
4. Linear Programming by G.Hadley.

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Machine Learning Laboratory (AI & ML) SEMESTER IV			
Subject Code	21AMAML4060	Internal Marks	15
Number of Lecture Hours/Week	3	External Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Pre-requisite	Data Structures		Credits -1.5

Course objectives:

Enable the students to

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

List of Experiments

1. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy.
2. Study of Python Libraries for ML application such as Pandas and Matplotlib.
3. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples.
4. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm
6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file.
7. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.
8. Write a program to construct a Bayesian network considering medical data.
9. Apply EM algorithm to cluster a set of data stored in a .CSV file.
10. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.
11. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.
12. Implement an algorithm to demonstrate the significance of genetic algorithm

Course Outcomes

1. Understand the implementation procedures for the machine learning algorithms
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms
4. Identify and apply Machine Learning alsgorithms to solve real world problems

Design and Analysis of Algorithms Lab SEMESTER IV			
Subject Code	21AMAML4070	Internal Marks	15
Number of Tutorial Hours/Week	03(P)	External Marks	35
Total Number of Practice Hours	48	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 datastructures.
- Apply important algorithmic design paradigms andmethods of analysis.
- Synthesize efficient algorithms in common engineeringdesign 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)

Floyd- Warshall Algorithm.

Course Outcomes:

On completion of the course student will able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. 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.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. For a given problem of dynamic-programming an develop the dynamic programming algorithms and analyze it to determine its computational complexity.

JAVA PROGRAMMING LAB SEMESTER IV			
Subject Code	21AMAML4080	Internal Marks	15
Number of Tutorial Hours/Week	3(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:

- Build software development skills using java programming for real world applications.
- Implement classical problems using java programming.
- Make the students to write programs using multithreading concepts and handle exceptions.
- Develop programs using java collection API as well as java Standard Library.
- make the students to create the Graphical User Interface using JavaFX.

List of experiments

Exercise 1 (Basics)

a) Write a Java program to display default value of all primitive data type of Java.
b) Write a Java Program to print the area of the Triangle
c) Write a Java program to check whether the given number is even or odd.

Exercise 2 (Basics-Continued)

a) Write a Java program to display the Fibonacci sequence
b) Write a Java program that display the roots of a quadratic equation ax2+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 3 (Operations, Expressions, Control-flow, Strings)

a) Write a Java program to search for an element in a given list of elements using binary search.
b) Write a Java program to sort given list of elements using bubble sort
c) Write a Java program using StringBuffer to delete, remove character.

Exercise 4 (Class, Objects, Methods)

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.
c) Write a Java program to implement constructor overloading.
d) Write a Java program implement 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 to find areas of different shapes usingabstract class.

Exercise 6 (Inheritance - Continued)

a) Write a Java program give example for "super" keyword.
b) Write a Java program to implement Interface.
c) Write a Java program that implements Runtimepolymorphism

Exercise 7 (Exceptions)

a) Write a Java program that describes exception handlingmechanism
b) Write a Java program for creation of Illustrating throw,throws and finally
c) Write a Java program to illustrate sub class exceptionprecedence over base class.
d) Write a Java program for creation of User DefinedException

Exercise 8 (Packages)

a) Write a Java program to create a package named pl andimplement ex1 class in it.
b) Write a Java program to create a package "mypack" andimport it in circle class.
c) Write a Java program illustrate class path

Exercise 9 (I/O)

a) Write a Java program to illustrate the concept of I/O Streams.
b) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, thetype of file and the length of the file in bytes.
c) Write a Java program that displays the number ofcharacters, lines and words in a text file.

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 Java program to illustrate the concept of Thread synchronization.
c) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication

Exercise 11 (Collections)

a) Write a Java program to create a new array list, add somecolors (string) and print out the collection.
b) Write a Java program to iterate a linked list in reverseorder.
c) Write a Java program to iterate through all elements in ahash list.
d) Write a Java program to associate the specified value withthe specified key in a HashMap.

Exercise 12 (JavaFX)

a) Write a Java program to demonstrate Mouse and Keyboard event Handling
b) Write a Java program to design a notepad editor.

COURSE OUTCOMES:

On completion of the course student will able to:

1. Understand and Apply Object oriented features and Java concepts.
2. Examine and analyze alternative solutions to a given problem using java.
3. Apply the concept of multithreading and implement exception handling.
4. Implement front end and back end of an application using Java
5. Develop applications using Console I/O and File I/O, GUI applications.

SOC: Fundamentals of Programming and Simulation using MATLAB for AI applications (AI & ML) SEMESTER IV			
Subject Code	21AMAMC4090	Internal Marks	15
Number of Lecture Hours/Week	1L+2P	External Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Pre-requisite	Data Structures	**Credits -2.0**	

Course objectives:

Enable the students to

- Learn the basic programming in MATLAB
- Learn to solve problems using MATLAB software
- Learn to solve problems using AI techniques using MATLAB
- Learn Simulation of a model to solve engineering problems
- Learn different AI toolboxes to solve problems

List of Experiments

1. Matrix athematic operations, finding inverse of matrices, finding Eigen values using MATLAB.
2. Polynomial roots finding, product and division of polynomials.
3. Polynomial curve fitting, polynomial evaluation, plotting using graphics.
4. Finding solutions of differential equations and nonlinear systems.
5. Finding solution of a problem using Genetic Algorithm by writing a program in MATLAB.
6. Finding solution of a problem using ANN techniques by writing a program in MATLAB.
7. Modelling of equations using Simulink and developing linear state space model from Simulink diagram
8. Solving a equation using Genetic Algorithm toolbox.
9. Solving a equation using Neural Networks toolbox.
10. Solving a problem using Fuzzy Logic toolbox.

COURSE OUTCOMES:

On completion of the course student will able to:

1. Understand and apply the programming skills to solve problems.
2. Understand the programming in MATLAB using polynomials.
3. To find solutions of nonlinear equations and also apply AI techniques to solve problems using MATLAB.
4. To understand Simulation skills to apply for solving engineering problems.
5. To understand different AI tool boxes to solve problems.

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT			
Subject Code	21CMMST5010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	69	Exam Hours	03
Credits – 03			

Unit -1: 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.	**16**
Unit -2: Production and Cost Analysis	
Production function-Isoquants and Isocost-Law of Variable proportions- Cobb-Douglas Production Function-Economics of Sale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	**14**
Unit – 3: 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: Market Skimming Pricing, And Internet Pricing: Flat Rate Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle	**13**
Unit – 4:Introduction to Accounting & Financing Analysis	
Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow cash flow statements (Simple Problems)	**12**
Unit – 5: 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.	**14**

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, Ambrish Gupta, Pearson Education, New Delhi.
R2	Managerial Economics, 4th Ed, H. Craig Peterson & W. Cris Lewis, 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%20engineering
W2	https://www.mooc-list.com/categories/economics-finance

Course Outcomes: On completion of this course, students can	
CO1	Students are equipped with the knowledge of managerial economics and estimating demand for a product.
CO2	Students understand Production and Cost concepts, estimating Cost Break even Analysis.
CO3	Students are equipped with the knowledge on Markets and Pricing methods along with Business Cycles.
CO4	Students are able to understand Accounting Concepts and Prepare Financial Statements- Analysis
CO5	Students are able to analyze various investment project proposals with the help of Capital Budgeting techniques.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	-	-	-	-	-	-	-	3	-	2	-
CO2	2	2	2	-	-	-	-	-	-	-	3	-	2	-
CO3	2	2	2	-	-	-	-	-	-	-	3	-	2	-
CO4	2	2	2	-	-	-	-	-	-	-	3	-	2	-
CO5	2	2	2	-	-	-	-	-	-	-	3	-	2	-
Course	**2**	**2**	**2**	-	-	-	-	-	-	-	**3**	-	**2**	**-**

COMPUTER NETWORKS			
Subject Code	21AMAMT5020	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: 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).	**08**
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, MQTT protocals, IOT protocals.	**10**
Unit – 4: Routing Algorithms	
Routing Algorithms- Shortest-Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast and Distance Vector Routing.	**10**
Unit – 5: Congestion Control & Application Layer	
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. 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.	**12**

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.
T3	Computer Networks, Mayank Dave, CENGAGE
T4	Data and Computer Communications, Fifth Edition, William Stallings, PHI, 2005.
R1	Computer Networks, A Systems Approach, Fifth Edition, Peterson & Davie, Harcourt, 2011.
R2	Network Management Standards, Second Edition, Ulysses Black, McGraw Hill, 1994
R3	Computer Networking - A Top-down Approach, Sixth Edition, James F. Kurose, Keith W. Ross, Pearson, 2013.
R4	Computer Networks - A Systems Approach, 5th ed, Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann/ Elsevier, 2011
W1	https://swayam.gov.in/courses/5172-computer-networks
W2	https://www.coursera.org/courses?query=computer%20network

Course Outcomes: On completion of this course, students can	
CO1	Understand OSI and TCP/IP models
CO2	Analyze MAC layer protocols and LAN technologies
CO3	Design applications using internet protocols
CO4	Understand routing and congestion control algorithms
CO5	Understand how internet works.

SOFTWARE ENGINEERING			
Subject Code	21AMAMT5030	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. *Agile Development*:What is an agile process?, Extreme Programming(XP). *Requirements Analysis and Specification:*Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.	**10**
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	
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.	**10**

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: On completion of this course, students can	
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

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	-

GRAPH THEORY (PROGRAM ELECTIVE-I)			
Subject Code	21AMAMT504A	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: Introduction	**Hours**
Introduction-Discovery of graphs, Definitions, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, Union, Sum, Cartesian Product, Composition, Graphic sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.	**08**
Unit -2: Connected graphs and shortest paths	
Connected graphs and shortest paths - Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra‟s shortest path algorithm, Floyd-Warshall shortest path algorithm.	**10**
Unit – 3: Trees	
Trees- Definitions and characterizations, Number of trees, Cayley‟s formula, Kircho↵-matrix-tree theorem, Minimum spanning trees, Kruskal‟s algorithm, Prim‟s algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury‟s algorithm, Chinese Postman problem, Hamilton Graphs, Introduction, Necessary conditions and sufficient conditions	**10**
Unit – 4: Independent sets coverings and matchings	
Independent sets coverings and matchings – Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall‟s Theorem, K¨onig‟s Theorem, Perfect matchings in graphs, Greedy and approximation algorithms	**10**
Unit – 5: Vertex Colorings	
Vertex Colorings- Basic definitions, Cliques and chromatic number, Mycielski‟s theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.	**12**

Text(T) / Reference(R) Books:	
T1	J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics. Springer, 1st edition, 2008.
T2	J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.
R1	Lecture Videos: http://nptel.ac.in/courses/111106050/13.
R2	Introduction to Graph Theory, Douglas B. West, Pearson.
R3	Schaum's Outlines Graph Theory, Balakrishnan, TMH.
R4	Introduction to Graph Theory, Wilson Robin j, PHI.
R5	Graph Theory with Applications to Engineering and Computer Science, Narsing Deo, PHI.
R6	Graphs - An Introductory Approach, Wilson and Watkins.

Course Outcomes: On completion of this course, students can	
CO1	Know some important classes of graph theoretic problems;
CO2	Know connected graphs and shortestvpaths;
CO3	Be able to formulate and prove central theorems about trees, matching, connectivity, colouring and planar graphs;
CO4	Be able to describe and apply some basic algorithms for graphs;
CO5	Be able to use graph theory as a modelling tool.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	-

WEB PROGRAMMING (PROGRAM ELECTIVE-I)			
Subject Code	21AMAMT504B	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: HTML & CSS	**Hours**
HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, frames, Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, Dynamic HTML CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms.	**10**
Unit -2: JAVASCRIPT	
JAVASCRIPT: Introduction to Javascript, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions.	**10**
Unit – 3: JDBC & NETWORKING	
JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– Inet Address class – URL class- TCP sockets – UDP sockets,	**10**
Unit – 4: AWT & SERVLETS	
AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.	**10**
Unit – 5: XML AND WEB SERVICES	
Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.	**8**

Text(T) / Reference(R) Books:	
T1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
T2	The complete Reference Java, 8th edition, Herbert Schildt, TMH.
T3	Michael Morrison XML Unleashed Tech media SAMS.
R1	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.
R2	Jon Duckett “Beginning Web Programming” WROX
R3	Marty Hall and Larry Brown “Core Servlets and Java Server pages Vol. 1: Core Technologies”, Pearson.
R4	Web Technologies, Uttam K Roy – Oxford

Course Outcomes: On completion of this course, students can	
CO1	Understand the basic concepts of HTML and CSS & apply those concepts to design static web pages.
CO2	Identify and understand various concepts related to dynamic web pages and validate them using JavaScript.
CO3	Able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
CO4	Able to write server-side applications using servlets.
CO5	Outline the concepts of Extensible markup language.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	**-**

COMPUTER VISION AND ROBOTICS (PROGRAM ELECTIVE-I)			
Subject Code	21AMAMT504C	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: CAMERAS, Radiometry – Measuring Light:	**Hours**
CAMERAS: Pinhole Cameras. **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases. **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models. Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	**08**
Unit -2: Linear Filters	
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates. **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges. **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	**10**
Unit – 3: The Geometry of Multiple Views, human vision	
The Geometry of Multiple Views: Two Views **Stereopsis:** Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras **Segmentation by Clustering:** What Is Segmentation? **Human Vision:** Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	**10**
Unit – 4: Segmentation by Fitting a Model	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice. **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples	**10**
Unit – 5: Geometric Camera Models	
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations.	**12**

Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization. **Model-Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	

Text(T) / Reference(R) Books:	
T1	David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.
R1	E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013
R2	R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
R3	Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011

Course Outcomes: On completion of this course, students can	
CO1	Implement fundamental image processing techniques required for computer vision
CO2	Implement boundary tracking techniques.
CO3	Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
CO4	Apply 3D vision techniques and Implement motion related techniques.
CO5	Develop applications using computer vision techniques.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	**-**

COMPUTER GRAPHICS (PROGRAM ELECTIVE-I)			
Subject Code	21AMAMT504D	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: Introduction and Output primitives	**Hours**
Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices Output primitives: Points and lines, line drawing algorithms (Bresenham's and DDA Algorithm), midpoint circle and ellipse algorithms Polygon Filling: Scan-line algorithm, boundary-fill and flood-fill algorithms	**08**
Unit -2: 2-D geometrical transforms and 2-D viewing	
2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems 2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland algorithms, Sutherland – Hodgeman polygon clipping algorithm	**10**
Unit – 3: 3-D object representation	
3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.	**10**
Unit – 4: 3-D Geometric transformations and 3-D viewing	
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.	**10**
Unit – 5: Computer animation	
Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications. Visible surface detection methods: Classification, back-face detection, depth-buffer, BSP-tree methods and area sub-division methods	**12**

Text(T) / Reference(R) Books:	
T1	"Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson Education
T2	Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
T3	Computer Graphics, Steven Harrington, TMH
R1	Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition
R2	Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.

R3	Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.

Course Outcomes: On completion of this course, students can	
CO1	Acquire knowledge on the fundamental concepts and theory of computer graphics.
CO2	Acquire familiarity with the relevant mathematics of computer graphics.
CO3	Be able to design basic graphics application programs.
CO4	Be able to design animations.
CO5	Be able to design applications that display graphic images to given specifications.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	**-**

COMPUTER NETWORKS LAB			
Subject Code	21AMAML5060	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 Programs

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.

Note: Implement programs 2 to 7 in C and 8 to 12 in JAVA.

Course Outcomes: On completion of this course, students can	
CO1	Understand and explain the basic concepts of Grid Computing.
CO2	Explain the advantages of using Grid Computing within a given environment
CO3	Prepare for any upcoming Grid deployments and be able to get started with a potentially available Grid setup.
CO4	Discuss some of the enabling technologies e.g. high-speed links and storage area networks.
CO5	Build computer grids.

SOFTWARE ENGINEERING LAB			
Subject Code	21AMAML5070	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			

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
Develop Time-line chart and project table using PERT or CPM project scheduling methods.
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	Able to translate end-user requirements into system and software requirements
CO2	Able to generate a high-level design of the system from the software requirements
CO3	Able to have experience and/or awareness of testing problems and will be able to develop a simple testing report

Soft Skills & Aptitude Builder - 1			
Subject Code		**IA Marks**	**15**
Number of Practice Hours/Week	**4**	**Exam Marks**	**35**
Total Number of Practice Hours	**64**	**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			**11**
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			**11**
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			**10**
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 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			**16**

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	**16**

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	S Agarwal, S Chand, 'Quantitative Aptitude'
T2	S Agarwal, S.Chand , 'A Modern Approach to Logical Reasoning'
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	, 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**

Course Outcomes to Programs Outcomes Mapping: (1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	-	1	-	**3**	-	-	-
2	-	-	-	-	-	-	-	-	**2**	1	-	**3**	-	-	-
3	-	-	-	-	-	-	-	-	**1**	1	-	**3**	-	-	-
4	**2**	**2**	-	**1**	-	-	-	-	-	-	-	**1**	-	-	-
5	**1**	**1**	-	**2**	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**2**	-	**2**	-	-	-	-	**2**	1	-	**3**	-	-	-

INTELLECTUAL PROPERTY RIGHTS (Mandatory Course)			
Subject Code	21CMAMN5090	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: Introduction to Intellectual property	**Hours**
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.	**08**
Unit -2: Trade Marks	
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.	**10**
Unit – 3: Law of copy rights	
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer	**10**
Unit – 4: Trade Secrets	
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.	**10**
Unit – 5: New development of intellectual property	
New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law	**12**

Text(T) / Reference(R) Books:	
T1	Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
R1	Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

Course Outcomes: On completion of this course, students can	
CO1	Understand Intellectual property rights and its types.
CO2	Demonstrate the Trade Marks of IPR.
CO3	Demonstrate the law of copy rights.

CO4	Demonstrate the trade secret laws and trade secrets.
CO5	Demonstrate new developments in intellectual property laws.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	**2**	-	-	-	-	-	-	-	-	-	**2**	-

III Year - II Semester

Deep Learning			
Subject Code	21AMAMT6010	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Credits -3.0			
Course Objective: To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training.			

Unit-1	**Hours**
Introduction History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation	10
Unit-2	
Activation functions and parameters: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters v/s Hyper-parameter	10
Unit-3	
Auto-encoders & Regularization: Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization	10
Unit-4	
Deep Learning Models: Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs	10
Unit-5	
Deep Learning Applications: Image Processing, Natural Language Processing, Speech recognition, Video Analytics	10

Course Outcomes: After completion of course, students would be able to:

1. Understand the fundamentals of deep learning and the main research activities in this field
2. Remember architectures and optimization methods for deep neural network training
3. Implement, apply and test relevant learning algorithms in TensorFlow
4. Critically evaluate the method's applicability in new contexts
5. Construct new applications to solve problems.

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
W2	https://www.mooc-list.com/categories/economics-finance

COMPILER DESIGN (PROFESSIONAL ELECTIVE-II)			
Subject Code	21AMMAT6040	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: Introduction	**Hours**
Introduction: The structure of a compiler, the science of building a compiler, programming language basics Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers	10
Unit -2: Syntax Analysis	
Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators.	**10**
Unit – 3: Syntax-Directed Translation and Intermediate-Code Generation	
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.	**10**
Unit – 4: Run-Time Environments	
Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection. Code Generation: Issues in the Design of a Code Generator, The Target Language, addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.	**10**
Unit – 5: Machine-Independent Optimization	
Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.	**10**

Text(T) / Reference(R) Books:	
T1	Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman.

R1	Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly.
R2	Compiler Construction, Louden, Thomson.

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate the ability to design a compiler given a set of language features.
CO2	Acquire skills in using lex tool & yacc tool for devloping a scanner and parser.
CO3	Design and implement LL and LR parsers.
CO4	Design algorithms to do code optimization in order to improve the performance of a program in terms of space and time complexity.
CO5	Design algorithms to generate machine code.

DATA WAREHOUSING AND MINING			
Subject Code	21AMAMT6030	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**
Data Warehouse and OLAP Technology: An Overview: Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber)	**10**
Unit -2	
Data Mining: Introduction, Data Mining, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality. Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin)	**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. Model Overfitting: Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)	**10**
Unit – 4	
Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Apriori Principle, Apriori Algorithm, Rule Generation, Compact Representation of Frequent Itemsets, FP-Growth Algorithm. (Tan &Vipin)	**10**
Unit – 5	
Cluster Analysis: Basic Concepts and Algorithms: Overview, 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 Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin)	**10**

Text(T) / Reference(R) Books:

T1	Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015.
T2	Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011
R1	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
R2	Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
R3	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
R4	Data Mining Techniques, Arun K Pujari, Universities Press, 2001

Web Resources:

1. NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

Course Outcomes: After the completion of the course, student will be able to	
CO1	Summarize the architecture of data warehouse
CO2	Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
CO3	Construct a decision tree and resolve the problem of model overfitting
CO4	Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation
CO5	Apply suitable clustering algorithm for the given data set

SOFTWARE TESTING METHODOLOGIES (Professional Elective – II)			
Subject Code	21AMAMT604X	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**
Introduction: Purpose of testing, Dichotomies, model for testing, 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, application of path testing.	**10**
Unit -2	
Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability	**10**
Unit – 3	
Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection. Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications	**12**
Unit – 4	
State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.	8
Unit – 5	
Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).	**10**

Text(T) / Reference(R) Books:	
T1	Software Testing techniques - Baris Beizer, Dreamtech, second edition.
T2	Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.
R1	Software Testing Techniques – SPD(Oreille)
R2	Software Testing in the Real World – Edward Kit, Pearson
R3	Effective methods of Software Testing, Perry, John Wiley.
R4	Art of Software Testing – Meyers, John Wiley.

Course Outcomes: After the completion of the course, student will be able to	
CO1	To provide knowledge of the concepts in software testing.
CO2	To provide knowledge of transaction flow testing techniques, Dataflow testing.
CO3	To provide knowledge of Paths, Path products and Regular expressions.
CO4	To understand the concepts of State, State Graphs and Transition testing
CO5	To develop skills in software test automation and management using latest tools.

INFORMATION RETRIEVAL SYSTEMS (Professional Elective – II)			
Subject Code	21AMAMT6010	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**
UNIT - I Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses. Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities.	**10**
Unit -2	
Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction. Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.	**10**
Unit – 3	
Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages. Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.	**10**
Unit – 4	
User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext. Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.	**10**
Unit – 5	
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems. Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.	**10**

Text(T) / Reference(R) Books:	
T1	Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer
T2	Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

R1	Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
R2	Modern Information Retrieval By Yates and Neto Pearson Education.

Course Outcomes: After the completion of the course, student will be able to	
CO1	Apply IR principles to locate relevant information large collections of data
CO2	Design different document clustering algorithms
CO3	Implement retrieval systems for web search tasks.
CO4	Use Information Visualization Technologies
CO5	Design an Information Retrieval System for web search tasks.

CRYPTOGRAPHY AND NETWORK SECURITY (Professional Elective – II)			
Subject Code	21AMAMT6010	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**
Introduction: Security attacks, services & mechanisms, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Phishing Defensive measures, SQL injection defense techniques, Format string vulnerabilities, TCP session hijacking (ARP attacks, route table modification) UDP hijacking (man-in-the-middle attacks).	**10**
Unit -2	
Traditional Block Cipher Structure, DES, Block Cipher Design Principles, AES-Structure, Transformation functions, Key Expansion, Blowfish, IDEA, Block Cipher Modes of Operations.	**10**
Unit – 3	
Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms. **Public Key Cryptography**: Principles, public key cryptography algorithms, RSA Algorithms, Diffie Hellman Key Exchange, Elgamal encryption & decryption, Elliptic Curve Cryptography.	**10**
Unit – 4	
Application of Cryptographic hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures, NIST Digital Signature Algorithm.	**10**
Unit – 5	
IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. **Intrusion detection:** Overview, Approaches for IDS/IPS, Signature based IDS, Host based IDS/IPS.	**10**

Text(T) / Reference(R) Books:	
T1	Cryptography & Network Security: Principles and Practices, William Stallings, PEA, Sixth edition. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech
T2	Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.David Irwin, CRC press
T3	Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech
R1	Machine Learning - Mc Graw Hill, Tom M. Mitchell.

R2	Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. PrenticeHall Pub

Course Outcomes: After the completion of the course, student will be able to	
CO1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO5	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.

Course Outcomes: After the completion of the course, student will be able to	
CO1	Understand the concept of Pattern Recognition.
CO2	Understand the algorithms for pattern recognition and machine learning.
CO3	Understand about different classifiers.
CO4	Understand about SVM
CO5	Understand about clustering and decision problems.

PATTERN RECOGNITION (Professional Elective – II)			
Subject Code	21AMAMT6010	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**
Introduction: Security attacks, services & mechanisms, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Phishing Defensive measures, SQL injection defense techniques, Format string vulnerabilities, TCP session hijacking (ARP attacks, route table modification) UDP hijacking (man-in-the-middle attacks).	**10**
Unit -2	
Traditional Block Cipher Structure, DES, Block Cipher Design Principles, AES-Structure, Transformation functions, Key Expansion, Blowfish, IDEA, Block Cipher Modes of Operations.	**10**
Unit – 3	
Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms. **Public Key Cryptography**: Principles, public key cryptography algorithms, RSA Algorithms, Diffie Hellman Key Exchange, Elgamal encryption & decryption, Elliptic Curve Cryptography.	**10**
Unit – 4	
Application of Cryptographic hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures, NIST Digital Signature Algorithm.	**10**
Unit – 5	
IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. **Intrusion detection:** Overview, Approaches for IDS/IPS, Signature based IDS, Host based IDS/IPS.	**10**

Text(T) / Reference(R) Books:	
T1	Cryptography & Network Security: Principles and Practices, William Stallings, PEA, Sixth edition. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech
T2	Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.David Irwin, CRC press
T3	Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech
R1	Machine Learning - Mc Graw Hill, Tom M. Mitchell.

R2	Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. PrenticeHall Pub

Course Outcomes: After the completion of the course, student will be able to	
CO1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO5	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.

Course Outcomes: After the completion of the course, student will be able to	
CO1	Understand the concept of Pattern Recognition.
CO2	Understand the algorithms for pattern recognition and machine learning.
CO3	Understand about different classifiers.
CO4	Understand about SVM
CO5	Understand about clustering and decision problems.

DEEP LEARNING LAB			
Subject Code	21AMAML6060	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments:

1. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7. Use a pre-trained convolution neural network (VGG16) for image classification.
8. Implement one hot encoding of words or characters.
9. Implement word embeddings for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Software Packages required:

- Keras
- Tensorflow
- PyTorch

TEXT BOOKS:

1. Reza Zadeh and Bharath Ramsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018.

REFERENCE BOOKS:

1. https://github.com/fchollet/deep-learning-with-python-notebooks

Course Outcomes: The end of the course student will be able to	
CO1	Implement deep neural networks to solve real world problems.
CO2	Choose appropriate pre-trained model to solve real time problem.
CO3	Interpret the results of two different deep learning models.

COMPILER DESIGN LAB			
Subject Code	21AMAML6070	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

1. Write a C program to identify different types of Tokens in a given Program.
2. Write a Lex Program to implement a Lexical Analyzer using Lex tool.
3. Write a C program to Simulate Lexical Analyzer to validating a given input String.
4. Write a C program to implement the Brute force technique of Top down Parsing.
5. Write a C program to implement a Recursive Descent Parser.
6. Write C program to compute the First and Follow Sets for the given Grammar.
7. Write a C program for eliminating the left recursion and left factoring of a given grammar
8. Write a C program to check the validity of input string using Predictive Parser.
9. Write a C program for implementation of LR parsing algorithm to accept a given input string. 10. Write a C program for implementation of a Shift Reduce Parser using Stack Data Structure to accept a given input string of a given grammar.
11. Simulate the calculator using LEX and YACC tool.
12. Generate YACC specification for a few syntactic categories.
13. Write a C program for generating the three address code of a given expression/statement.

TEXT BOOKS:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson Publishers, 2007.

REFERENCE BOOKS:

1. John R Levine, Tony Mason, Doug Brown, "Lex and Yacc", Orielly, 2nd Edition, 2009.

Course Outcomes: The end of the course student will be able to	
CO1	C Design simple lexical analyzers x Apply Lex and Yacc tools
CO2	Determine predictive parsing table for a CFG
CO3	Examine LR parser and generating SLR Parsing table
CO4	Relate Intermediate code generation for subset C language

DATA MINING USING PYTHON LAB			
Subject Code	21AMAML6080	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments:

Note: Use python library scikit-learn wherever necessary

1. 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
2. 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
3. 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
4. Build a model using linear regression algorithm on any dataset.
5. Build a classification model using Decision Tree algorithm on iris dataset
6. Apply Naïve Bayes Classification algorithm on any dataset
7. Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data.
8. Apply K- Means clustering algorithm on any dataset.
9. Apply Hierarchical Clustering algorithm on any dataset.
10. Apply DBSCAN clustering algorithm on any dataset.

Web References:

1. https://analyticsindiamag.com/data-pre-processing-in-python/
2.https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3.https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4.https://www.springboard.com/blog/data-mining-python-tutorial/
5.https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6.https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
7.https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
8.https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learnd690cbae4c5

Course Outcomes: The end of the course student will be able to	
CO1	Apply preprocessing techniques on real world datasets
CO2	Apply apriori algorithm to generate frequent item sets.
CO3	Apply Classification and clustering algorithms on different datasets.

Soft Skills & Aptitude Builder - 2			
Subject Code		**IA Marks**	**15**
Number of Practice Hours/Week	**4**	**Exam Marks**	**35**
Total Number of Practice Hours	**64**	**Exam Hours**	**3**
Credits - 2			
Section A **Soft Skills**			
Unit – 1: Communicative Competence			**Hours**
Verbal Reasoning: Selecting Words, Spotting Errors, Ordering of Words, Sentence Formation, Paragraph Formation, Ordering of Sentences, Reading Comprehension, Completing Statements, Verbal Analogies, Cause and Effect, Syllogism, Logical Sequence of Words, Verbal Reasoning, Analysing Arguments, Verification of Truth, Matching Definitions, Theme Detection E-Mail Etiquette, Reporting News Activity: Completing Textual Exercises			**16**
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, Presentations, Digital Resumes			**16**
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			**11**
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			**11**

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.	
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	**10**

Text (T) / Reference (R) Books:	
For Units 1 & 2	
T1	**R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003**
T2	**Soft Skills: Enhancing Employability: Connecting Campus with Corporate by MS Rao, IK International Publishing House**
R2	**How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill**
For Units 3, 4, & 5	
T1	S Agarwal, S Chand, 'Quantitative Aptitude'
T2	S Agarwal, S.Chand , 'A modern approach to Logical reasoning'
R1	Quantitative Aptitude for CAT By Arun sharma
R2	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**

Course Outcomes to Programs Outcomes Mapping: (1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	-	3	-	**1**	-	-	-
2	-	-	-	-	-	-	-	-	-	2	-	**3**	-	-	-
3	**2**	**2**	-	**1**	-	-	-	-	-	-	-	**1**	-	-	-
4	**1**	**1**	-	**2**	-	-	-	-	-	-	-	**1**	-	-	-
5	**2**	**2**	-	**1**	-	-	-	-	-	-	-	**1**	-	-	-
Course	**2**	**2**	-	**1**	-	-	-	-	-	2	-	**2**	-	-	-

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (Mandatory Course)			
Subject Code	**21CMAMN6100**	Internal Marks	30
Number of Lecture Hours/Week	02	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

Course Objectives:

The objectives of this course is enable the students to

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.

Unit -1	**Hours**
Introduction to Traditional Knowledge Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge	**10**
Unit -2	
Protection Of Traditional Knowledge Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	**10**
Unit – 3	
Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.	**10**
Unit – 4	
Traditional Knowledge And Intellectual Property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.	**10**
Unit – 5	
Traditional Knowledge In Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.	**10**

Course Outcomes:

At the end of this course the student will be able to

1. Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes on traditional knowledge system.
2. Describe the significance of traditional knowledge protection to communicate the

traditional knowledge information

3. Recognize the role of government on traditional knowledge to measure its impact on global economy.
4. Explain the acts related to schedule tribes, traditional forest dwellers, plants protection and farmers to inculcate the legal protection information.
5. Illustrate the rules of biological diversity and geographical indicators for the protection of traditional knowledge bill.

TEXT BOOKS

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

REFERENCES

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

IV Year - I Semester

INTERNET OF THINGS (Professional Elective - III)			
Subject Code	21AMAMT701A	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**
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.	**10**
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	
Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.	**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 the World.	**10**

Text(T) / Reference(R) Books:	
T1	Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
T2	Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,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: After the completion of the course, student will be able to	
CO1	Explain in a concise manner how the general Internet as well as Internet of Things work.
CO2	Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
CO3	Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
CO4	Develop prototype models for various applications using IoT technology.

REINFORCEMENT LEARNING (Professional Elective - III)			
Subject Code	21AMAMT701B	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**
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.	**10**
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.	**10**

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	**NPTEL Link:** Reinforcement Learning: https://onlinecourses.nptel.ac.in/noc22_cs34/preview

Course Outcomes: After the completion of the course, student will be able to	
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	Recognize current advanced techniques and applications in RL

DEVOPS (Professional Elective - III)			
Subject Code	21AMAMT701C	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**
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	**10**

Text(T) 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

Course Outcomes: After the completion of the course, student will be able to	
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

BLOCK CHAIN TECHNOLOGIES (Professional Elective - III)			
Subject Code	21AMAMT701D	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	49	Exam Hours	03
Credits – 03			

Unit -1	**Hours**
Introduction: Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets.	**10**
Unit -2	
Hashing, public key cryptosystems, private vs public block chain and use cases, HashPuzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment	**10**
Unit – 3	
Introduction to Bitcoin: Bitcoin Block chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics, Bit coin MOOCs.	**10**
Unit – 4	
Ethereum continued, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption,Currency Multiplicity, Demurrage currency	**10**
Unit – 5	
Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems.	**9**

Text(T) / Reference(R) Books:	
T1	Blockchain Blue print for Economy by Melanie Swan
R1	Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher

Course Outcomes: After the completion of the course, student will be able to	
CO1	Demonstrate the block chain basics, Crypto currency
CO2	To compare and contrast the use of different private vs. public block chain and use cases
CO3	Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins
CO4	Classify Permission Block chain and use cases – Hyper ledger, Corda
CO5	Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others

ROBOTIC PROCESS AUTOMATION (Professional Elective – IV)			
Subject Code	21AMAMT702A	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**
Introduction to Robotic Process Automation: Scope and techniques of automation, Robotic process automation, What can RPA do, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. **RPA Basics**: History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.	**10**
Unit -2	
RPA Tool Introduction and Basics: **Introduction to RPA Tool:** The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation, Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data	**10**
Unit – 3	
Advanced Automation Concepts & Techniques: Recording Introduction, Basic and Desktop Recording, Web Recording, Input/ Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.	**10**

Unit – 4	
Handling User Events & Assistant Bots, Exception Handling: What are assistant bots, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event. **Exception Handling:** Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.	**10**
Unit – 5	
Deploying and Maintaining The Bot: Publishing using publish utility, Creation of Server, Using Server to control the bots, Creating a provision Robot from the Server, Connecting a Robot to Server, Deploy the Robot to Server, Publishing and managing updates, Managing packages, Uploading packages, Deleting packages	**10**

Text(T) / Reference(R) Books:	
T1	Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.
R1	Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
R2	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
R3	Srikanth Merianda, "Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
R4	Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

Web References:

W1. https://www.uipath.com/rpa/robotic-process-automation

W2. https://www.academy.uipath.com

Course Outcomes: After the completion of the course, student will be able to	
CO1	Describe RPA, where it can be applied and how it's implemented
CO2	Describe the different types of variables, Control Flow and data manipulation techniques.
CO3	Identify and understand Image, Text and Data Tables Automation
CO4	Describe how to handle the User Events and various types of Exceptions and strategies.
CO5	Understand the Deployment of the Robot and to maintain the connection.

NATURAL LANGUAGE PROCESSING (Professional Elective – IV)			
Subject Code	21AMAMT702B	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**
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.	**10**
Unit -2	
Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – 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).	**10**

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	Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
R2	Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
R3	Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010. Edition
R4	Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

Course Outcomes: After the completion of the course, student will be able to	
CO1	Demonstrate a given text with basic Language features
CO2	To design an innovative application using NLP components
CO3	Explain a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare and contrast the use of different statistical approaches for different types of NLP applications.

BIG DATA ANALYTICS (Professional Elective – IV)			
Subject Code	21AMAMT702C	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**
Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.	**10**
Unit -2	
Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.	**10**
Unit – 3	
Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment	**10**
Unit – 4	
Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.	**10**
Unit – 5	
Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application	**10**

Text(T) / Reference(R) Books:	
T1	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
T2	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
T3	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012
R1	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.

R2	Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data:The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
R3	Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.
R4	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.

Course Outcomes: After the completion of the course, student will be able to	
CO1	Illustrate big data challenges in different domains including social media, transportation, finance and medicine
CO2	Use various techniques for mining data stream
CO3	Design and develop Hadoop
CO4	Identify the characteristics of datasets and compare the trivial data and big data for various applications
CO5	Explore the various search methods and visualization techniques

SOFT COMPUTING (Professional Elective – IV)			
Subject Code	21AMAMT702D	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**
Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations. Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models.	**10**
Unit -2	
Optimization: Derivative based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms	**10**
Unit – 3	
Artificial Intelligence: Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning, Heuristic Search: Techniques for Heuristic search Heuristic Classification.	**10**
Unit – 4	
Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum.	**10**
Unit – 5	
Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.	**10**

Text(T) / Reference(R) Books:	
T1	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004
T2	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.
R1	Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
R2	Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
R3	Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
R4	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,

Course Outcomes: After the completion of the course, student will be able to	
CO1	Able to apply fuzzy logic and reasoning to handle uncertainty in engineering problems Make use of genetic algorithms to combinatorial optimization problems
CO2	Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
CO3	Learn and apply the principles of self adopting and self organizing neuro fuzzy inference systems
CO4	Evaluate and compare solutions by various soft computing approaches for a given problem

CLOUD COMPUTING (Professional Elective – V)			
Subject Code	21AMAMT703A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	49	Exam Hours	03
Credits – 03			

Unit -1	**Hours**
Systems Modeling, Clustering and Virtualization: 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, 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, general parallel file systems. Google file system..	**9**

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, ArshadeepBahga, 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

Course Outcomes: After the completion of the course, student will be able to	
CO1	Illustrate the key dimensions of the challenge of Cloud Computing
CO2	Classify the Levels of Virtualization and mechanism of tools
CO3	Analyze Cloud infrastructure including Google Cloud and Amazon Cloud
CO4	Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
CO5	Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

EXPERT SYSTEMS (Professional Elective – V)			
Subject Code	21AMAMT702C	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**
Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Min-Max algorithms, game playing – Alpha-beta pruning.	**10**
Unit -2	
Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems.	**10**
Unit – 3	
Introduction to Expert Systems, Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.	**10**
Unit – 4	
Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems	**10**
Unit – 5	
Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process. Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts, difficulties during development	**10**

Text(T) / Reference(R) Books:	
T1	Elain Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hill, New Delhi.
T2	Waterman D.A., “A Guide to Expert Systems”, Addison Wesley Longman
R1	Stuart Russel and other Peter Norvig, “Artificial Intelligence – A Modern Approach”, Prentice-Hall.
R3	Patrick Henry Winston, “Artificial Intelligence”, Addison Wesley
R4	Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999.
R5	Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley.
R6	Weiss S.M. and Kulikowski C.A., “A Practical Guide to Designing Expert Systems”, Rowman & Allanheld, New Jersey.

Course Outcomes: After the completion of the course, student will be able to

CO1	Apply the basic techniques of artificial intelligence.
CO2	Discuss the architecture of an expert system and its tools.
CO3	Understand the importance of building an expert system.
CO4	Understand various problems with an expert system.

DATA VISUALIZATION (Professional Elective – V)			
Subject Code	21AMAMT703C	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**
Introduction to Data Visualizations and Perception: Introduction of visual perception, visual representation of data, Gestalt principles, Information overload.	**10**
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.	**10**

Text(T) / Reference(R) Books:	
T1	Ward, Grinstein, Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick, 2nd edition,A K Peters, Ltd 2015.
R1	Tamara Munzner,Visualization Analysis & Design ,1st edition,AK Peters Visualization Series 2014.
R2	Scott Murray,Interactive Data Visualization for the Web ,2nd Edition, 2017

Course Outcomes: After the completion of the course, student will be able to	
CO1	Identify and recognize visual perception and representation of data.
CO2	Illustrate about projections of different views of objects.
CO3	Apply various Interaction and visualization techniques.
CO4	Analyze various groups for visualization.
CO5	Evaluate visualizations

SEMANTIC WEB (Professional Elective – V)			
Subject Code	21AMAMT703D	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**
Web Intelligence: 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.	**10**

Text(T) / Reference(R) Books:	
T1	Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
T2	Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
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: After the completion of the course, student will be able to	
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.

MANAGEMENT SCIENCE			
Subject Code	21AMMST7060	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 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. Workstudy, 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 & LayoutStudy &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.	**10**

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.

MACHINE LEARNING WITH GO (Skill Oriented Course)			
Subject Code	21AMAML7070	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 2			

Prerequisites:

1. Bash Shell
2. Go-an editor

List of Experiments:

1. a) Write a Go program to read CSV file and find the maximum value in a particular column.

b) Write a Go program to read iris dataset which is in csv format and demonstrate handling of unexpected fields, types and manipulating CSV data.

2. a) Demonstrate how JSON data can be parsed using Go.

b) Demonstrate how to connect and Querying SQL like databases (Postgres MySQL, SQL Lite) using Go

3. Demonstrate how to cache data in memory using Go

4. a) Demonstrate how to represent matrices and vectors in Go

b) Write a Go program to get statistical measures like mean, median, standard deviation and so on for any dataset.

c) Write a Go program to visualize data distributions using Histogram, Box Plots

5. a) Write a Go program to demonstrate Mean Squared Error (MSE), Mean Absolute Error (MAE) , R 2 (R Squared).

b) Write a Go program to compute Accuracy, Precision, Recall, AUC (Area Under Cover)

6. a) Demonstrate how to build a linear regression model using Go. b) Demonstrate how to build a multiple linear regression model using Go.

7. Demonstrate how to build a logistic regression model using Go

8. Apply k-nearest neighbor classifier on iris dataset using Go

9. Build a decision tree on iris dataset using Go.

10. Demonstrate K-Means clustering method using Go.

11. Build auto regressive models for time series data using Go

12. Demonstrate how to build a simple neural network using Go

References: 1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944292286873602383_share d/overview

Course Outcomes: The end of the course student will be able to	
CO1	Apply preprocessing techniques on real world datasets
CO2	Apply apriori algorithm to generate frequent item sets.
CO3	Apply Classification and clustering algorithms on different datasets.

IV Year -II Semester

Proposed Course Structure for IV B.Tech AIML Under the Regulations of SITE-21							
Semester -VIII							
S.No	Subject Code	Course Code	Course	L	T	P	C
1	PC	21AMMAT5010	Project Work	3	0	0	12
			TOTAL				**12**

Minors Courses

Department of Artificial Intelligence and Machine Learning
Minor Courses (For other Departments)

Note:

1. Any FOUR courses need to be studied from PART-A after their completion of II B. Tech I Sem.
2. From Part B, TWO, NPTEL courses of minimum EIGHT-week duration covering a total of 4 credits (offered by AI & ML Department) should be completed, Student can register at any time after the completion of II B.Tech. I Sem.
3. Students can pursue suggested MOOC Courses via NPTEL from II B. Tech II Sem and onwards, by prior information to the concern.

PART A

Minor Degree in "Artificial Intelligence and Machine Learning"						
S.No	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**
1	21YYAMMXXXX	Soft Computing	3	1	0	4
2	21YYAMMXXXX	Introduction to AI & Machine Learning	3	1	0	4
3	21YYAMMXXXX	Introduction to Data Science	3	1	0	4
4	21YYAMMXXXX	Deep Learning	3	1	0	4
5	21YYAMMXXXX	IOT	3	1	0	4
		Total Credits (Any 4 Courses)				16

PART B

S.No	Name of the MOOC Course	Course Instructor	Links
1	Artificial Intelligence: Search Methods for Problem solving	Prof. Deepak Khemani, IITM	https://onlinecourses.nptel.ac.in/noc22_cs67/preview
2	Introduction to Machine Learning	Prof. Balaraman Ravindran, IITM	https://onlinecourses.nptel.ac.in/noc22_cs73/preview
3	Data Science for Engineers	Prof. Ragunathan Rengasamy Prof. Shankar Narasimhan, IITM	https://onlinecourses.nptel.ac.in/noc22_cs72/preview
4	Machine Learning for Engineering and Science Applications	Dr. Balaji Srinivasan, IIT Madras	https://nptel.ac.in/courses/106106198

Soft Computing			
Subject Code	21YYAMMXXXX	Internal Marks	30
Number of Lecture Hours/Week	3L+1T	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite		**Credits -4.0**	

Course Objective: To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training.

Unit-1	**Hours**
Introduction to neural networks Structure and working of Biological Neural Network, Fundamentals of Artificial Neural Networks & Applications, Characteristics of Artificial Neural Networks, History of neural network research, characteristics of neural networks terminology	10
Unit-2	
Neural networks models and Learning Methods Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks, Learning Methods, Backpropagation, Counter propagation, ART, BAM, Associative memories.	10
Unit-3	
Introduction, Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification, Architecture of a Neuro-Fuzzy system and its applications.	10
Unit-4	
Supervised learning: Primitive algorithms, Generative algorithms, Support Vector Machine, Ensemble methods. Unsupervised learning: K-means, Principal component analysis, Independent component analysis. Reinforcement learning and control.	10
Unit-5	
Applications Applications of GA & GP, Hybrid systems.	10

Course Outcomes: After completion of course, students would be able to:

1. Understand, Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Apply a soft computing methodology for a particular problem.
3. Analyze and compare solutions by various soft computing approaches for a given problem. 4. Apply genetic algorithms to combinatorial optimization problems.
5. Evaluate and compare solutions by various soft computing approaches for a given problem.

Text Books/Suggested References:

1. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996
2. Learning and Soft Computing by Kecman, Pearson Education, 2001
3. Fuzzy Sets and Fuzzy Logic - Klir and Yuan, PHI, 1995
4. Neural Network in computer Intelligence by Fu, TMH, 2003
5. Bio-Inspired Artificial Intelligence – Dario Floreano, PHI, 2008
6. Soft Computing – Ikvinderpal Singh, Khanna Book Publishing 2015.

Introduction to AI & Machine Learning			
Subject Code	21YYAMMXXXX	Internal Marks	30
Number of Lecture Hours/Week	3L+1T	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite		**Credits -4.0**	

Course objectives:

Enable the students to

- To review and strengthen important mathematical concepts required for AI & ML.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Unit-1	**Hours**
Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	10
Unit-2	
Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.	10
Unit-3	
Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.	10
Unit-4	
Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	10
Unit-5	
Discussion on clustering algorithms and use-cases cantered around clustering and classification.	10

Course outcomes:

On completion of the course student will be able to:

1. Design and implement machine learning solutions to classification, regression and clustering problems.
2. Evaluate and interpret the results of the different ML techniques.
3. Design and implement various machine learning algorithms in a range of Real-world applications.
4. Learn Regression techniques.
5. Learn clustering algorithms.

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

Reference Books:

1. Wolfgang Ertel, "Introduction to Artificial Intelligence", 1st Edition, Springer, 2017.
2. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.

Introduction to Data Science			
Subject Code	21YYAMMXXXX	Internal Marks	30
Number of Lecture Hours/Week	3L+1T	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite		**Credits -4.0**	

Course objectives:

Enable the students to

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

- Apply principles of NumPy and Pandas to the analysis of data.
- Make use of various file formats in loading and storage of data.
- Identify and apply the need and importance of pre-processing techniques.
- Show the results and present them in a pictorial format.
- Critically evaluate data visualizations based on their design

Unit-1	**Hours**
Data science: definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process. NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.	10
Unit-2	
Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data	10
Unit-3	
Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats,Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB .	10
Unit-4	
Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.	10
Unit-5	
Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends,	10

Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots	

Course outcomes:

On completion of the course student will be able to:

1. Design and implement machine learning solutions to classification, regression and clustering problems.
2. Evaluate and interpret the results of the different ML techniques.
3. Design and implement various machine learning algorithms in a range of Real-world applications.
4. Learn merging of Data sets and wrangling.
5. Learn different libraries for plotting the data sets and learn visualization.

Text Books:

1) Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2) Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

Reference Books:

1) Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
2) Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.

<table>
<tr><th colspan="4">Deep Learning</th></tr>
<tr><td>Subject Code</td><td>21YYAMMXXXX</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3L+1T</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Neural networks</td><td colspan="2">Credits -4.0</td></tr>
<tr><td colspan="4">Course Objective: To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training.</td></tr>
<tr><td colspan="3">Unit-1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation</td><td>10</td></tr>
<tr><td colspan="3">Unit-2</td><td></td></tr>
<tr><td colspan="3">Activation functions and parameters: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters v/s Hyper-parameter</td><td>10</td></tr>
<tr><td colspan="3">Unit-3</td><td></td></tr>
<tr><td colspan="3">Auto-encoders & Regularization: Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization</td><td>10</td></tr>
<tr><td colspan="3">Unit-4</td><td></td></tr>
<tr><td colspan="3">Deep Learning Models: Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs</td><td>10</td></tr>
<tr><td colspan="3">Unit-5</td><td></td></tr>
<tr><td colspan="3">Deep Learning Applications: Image Processing, Natural Language Processing, Speech recognition, Video Analytics</td><td>10</td></tr>
<tr><td colspan="4">Course Outcomes: After completion of course, students would be able to:
1. Understand the fundamentals of deep learning and the main research activities in this field
2. Remember architectures and optimization methods for deep neural network training
3. Implement, apply and test relevant learning algorithms in TensorFlow
4. Critically evaluate the method’s applicability in new contexts
5. Construct new applications to solve problems.</td></tr>
<tr><td colspan="4">Text Books/Suggested References: 1. Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016
2. Bengio, Yoshua. “ Learning deep architectures for AI.” Foundations and trends in Machine Learning 2.1, Now Publishers, 2009
3. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.
4. https://nptel.ac.in/courses/106/106/106106184/</td></tr>
</table>

IOT			
Subject Code	21YYAMMXXXX	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	3
Pre-requisite	Machine Learning	**Credits -4.0**	
Course Objective: To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training.			
Unit-1			**Hours**
Introduction to IoT: What is IoT, how does it work? Difference between Embedded device and IoT device, Properties of IoT device, IoT Ecosystem, IoT Decision Framework, IoT Solution Architecture Models, Major IoT Boards in Marke			10
Unit-2			
Setting Up Raspberry/Arduino to Create Solutions: Explore Raspberry Pi, setting up Raspberry Pi, showing working of Raspberry Pi using SSH Client and Team Viewer, Understand Sensing actions, Understand Actuators and MEMS			10
Unit-3			
Communication Protocols used in IoT: Types of wireless communication, Major wireless Shortrange communication devices, properties, comparison of these devices (Bluetooth, WIFI, ZigBee, 6LoWPAN), Major wireless Long-range communication devices, properties, comparison of these devices (Cellular IoT, LPWAN)			10
Unit-4			
IoT Applications: Industrial Internet 4.0, Applications such as: Smart home, wearables, smart city, smart grid, connected car, connected health (digital health, telehealth, telemedicine), smart retail			10
Unit-5			
Sensors: Applications of various sensors: Google Maps, Waze, WhatsApp, Ola Positioning sensors: encoders and accelerometers, Image sensors: cameras, Global positioning sensors: GPS, GLONASS, IRNSS, Galileo and indoor localization systems, Motion & Orientation Sensors: Accelerometer, Magnetometer, Proximity Sensor, Gyroscope Calibration, noise modeling and characterization and noise filtering, Privacy &Security			10
Course Outcomes: After completion of course, students would be able to: 1. Understand core technology, applications. 2. Understand Raspberry's working and implementation. 3. Understand various communication protocols used in IoT. 4. Apply various IOT technologies in real-life applications. 5. Understand sensors used and IOT architecture along with the industry perspective.			
Text Books / Suggested References: 1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014 2. Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1stEdition, Apress Publications, 2014 3. Cuno Pfister, Getting Started with the Internet of Things, O Reilly Media, 2011.			