SITE21

COURSE STRUCTURE AND DETAILED SYLLABUS

for

Computer Science and Engineering - Artificial Intelligence

&

Machine Learning

REGULATIONS,

COURSE STRUCTURE

For

I B.Tech.

Common to all Branches

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 first year
j. "Lateral entry Students" Means student enrolled into the four year programme in the second year

1.3. Academic Programs

1.3.1. Nomenclature of Programs

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

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

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

1.3.2. Curriculum Structure

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the

stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

1.3.3. Induction Program

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

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

1.4Admission Criteria

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

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

2. Award of B. Tech. Degree

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

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

3. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years
b) Each Academic year of study is divided into Two Semesters.
c) Minimum number of instruction days in each semester is 90.
d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
e) The total credits for the Programme is 160.
f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
g) Student is introduced to "Choice Based Credit System (CBCS)".
h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
i) A student has to register for all courses in a semester.
j) All the registered credits will be considered for the calculation of final CGPA.

k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'.Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.

m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.

n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration / career growth/placements/opportunities for higher studies/ GATE / other competitive exams etc.

4. Registration for Courses:

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.

b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

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

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

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

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

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

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

v. Credits are defined as per AICTE norms.

(b) Award of B. Tech. (Honor)/B. Tech. (Minor):B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for an Honors/Minor is optional.

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.

Example: **Mid-1 marks** = Marks secured in
(Online examination-1 + descriptive examination-1 +one assignment-1)
Mid-2 marks = Marks secured in
(Online examination-2+descriptive examination-2+one assignment-2)

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.
d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. 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. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.
e) 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.

f) 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.

g) **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.

h) ***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 (SITE21M) FOR B.Tech (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 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 121 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)

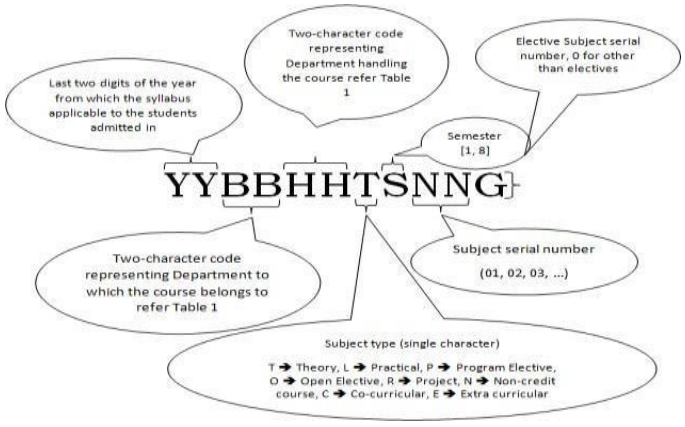


Figure 1: Course Numbering Scheme

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 Engineering	CS
Computer Science Technology	CT
Information Technology	IT

Management Science	MS
Mathematics	MA
Physics	PH
Chemistry	CH
English	EG
Biology	BI
Common to All Branches	CM

Example: ED in 3rd semester for ECT with S.No 3

Course Code: 21ETETT3030

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

S. No.	Category		No. of Credits									
			ECE/ECT		EEE		CSE/IT/CST		ME		CE	
		AICTE	APSCHE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approv
1	Humanities and Social Sciences	12	7	7.5	12	11	12	11	12	11	12	08
2	Basic Science courses	25	18	21	26	25	24	26	25	26	26	26
3	Engineering Science courses	24	22.5	19.5	20	20	29	29.5	24	23	29	24.5
4	Professional Core courses	48	55.5	55.5	53	62	49	48.5	48	55	47	56.5
5	Professional Elective Courses	18	15	15	18	15	18	18	18	18	23	21
6	Open elective courses	18	15	15	18	12	12	12	18	12	11	9
7	Project work , Seminar and Internship	15	26.5	26.5	11	15	15	15	15	15	12	15
8	Mandatory Courses	-		-	-	-	-	-	-	-	-	-
Total Credits		160	160	160	158	160	159	160	160	160	160	160

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 act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The

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

MALPRACTICES

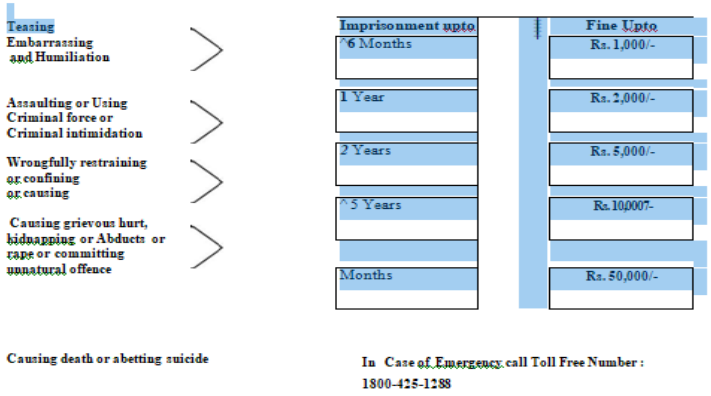
- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the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



In Case of Emergency call Toll Free Number :
1800-425-1288

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.

I B.Tech I Semester Course Structure SITE21 Regulations						
Common for CSE,ECE &IT						
S.N	Subject Code	Course	L	T	P	C
1	21CMEGT1010	Technical English	3	0	0	3
2	21CMMAT1020	Engineering Mathematics-I	3	0	0	3
3	21CMEET1030	Basic Electrical Engineering	3	0	0	3
4	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	21CSMEL1050 21ECMEL1050 21ITMEL1050	Computer Aided Engineering Graphics	2	0	2	3
6	21CMEGL1060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL1070	Basic Electrical Engineering Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMESN1090	Environmental Science	2	0	0	0
TOTAL			**16**	**0**	**11**	**19.5**

I B.Tech II Semester Course Structure SITE21 Regulations						
Common for CSE,ECE,IT						
S.N	Subject code	Course	L	T	P	C
1	21CMMAT2010	Engineering Mathematics - II	3	0	0	3
2	21CSPHT2020 21ECPHT2020 21ITPHT2020	Engineering Physics	3	0	0	3
3	21CMCHT2030	Engineering Chemistry	3	0	0	3
4	21CMCST2040	Python Programming	3	0	0	3
5	21ECECT2050	Network Analysis	3	0	0	3
5	21CSCST2050 21ITITT2050	Data Structures	3	0	0	3
6	21CSPHL2060 21ECPHL2060 21ITPHL2060	Engineering Physics Lab	0	0	3	1.5
7	21CMEEL2070	Engineering Chemistry Lab	0	0	3	1.5
8	21ECMEL2080	Engineering Workshop	0	0	3	1.5
8	21CSCSL2080 21ITITL2080	Data Structures Lab	0	0	3	1.5
9	21CMMSN2090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
TOTAL			**16**	**0**	**11**	**19.5**

I B.Tech I Semester Course Structure SITE21 Regulations						
Common for AI&ML,CE,CST,ECT, EEE, ME						
SN	Subject Code	Course	L	T	P	C
1	21CMMAT1010	Engineering Mathematics – I	3	0	0	3
2	21AMPHT1020 21CEPHT1020 21CTPHT1020 21ETPHT1020 21EEPHT1020 21MEPHT1020	Engineering Physics	3	0	0	3
3	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	21AMMEL1050 21CTMEL1050 21ETMEL1050	Computer Aided Engineering Graphics	2	0	2	3
5	21CEMEL1050 21EEMEL1050 21MEMEL1050	Engineering Graphics	2	0	2	3
6	21AMPHL1060 21CEPHL1060 21CTPHL1060 21ETPHL1060 21EEPHL1060 21MEPHL1060	Engineering Physics Lab	0	0	3	1.5

7	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMMSN1090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
TOTAL			**16**	**0**	**11**	**19.5**

I B.Tech II Semester Course Structure SITE21 Regulations						
Common for AI &ML,CE, CST,ECT,EEE &ME						
S.N	Subject Code	Course	L	T	P	C
1	21CMEGT2010	Technical English	3	0	0	3
2	21CMMAT2020	Engineering Mathematics – II	3	0	0	3
3	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	21CMCST2040	Python Programming	3	0	0	3
5	21ETETT2050	Network Analysis	3	0	0	3
5	21AMAMT2050 21CTCTT2050	Data Structures	3	0	0	3
5	21CEMET2050 21EEMET2050 21MEMET2050	Engineering Mechanics	3	0	0	3
6	21CMEGL2060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
7	21AMAML2070 21CTCTL2070	Data Structures Lab	0	0	3	1.5
8	21CEMEL2080 21EEMEL2080 21ETMEL2080 21MEMEL2080	Engineering Workshop Lab	0	0	3	1.5
9	21CMCHN2090	Environmental Science	2	0	0	0
TOTAL			**16**	**0**	**11**	**19.5**

TECHNICAL ENGLISH SEMESTER I/II			
Subject Code	21CMEGT1010/2010	IA Marks	30
Number of Lecture Hr/We	03	Exam Marks	70
Total Number of Lecture Hr	50	Exams Hours	03
Credits -03			

Course Objectives:

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

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

Unit I

Principles of Scientific Vocabulary • Principles of Scientific vocabulary: short and simple words-compact substitutes for wordy phrases-redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words • The role of roots in word building, prefixes and suffixes, confusing words and expressions.	10 hours
Unit II	
Writing Skills • Distinguishing between academic and personal styles of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing • Measuring the clarity of a text through Fog Index or Clarity Index	10 hours
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • Avoiding the pitfalls	10 hours
Unit IV	
Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying • Effective use of charts, graphs, and tables	10 hours
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: 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. **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 1Reference 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

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**
1	-	-	-	-	-	-	-	-	-	**2**	-	-
2	-	-	-	-	-	-	-	-	-	**2**	-	-
3	-	-	-	-	-	-	-	-	-	**2**	-	-
4	-	-	-	-	-	-	-	-	-	**2**	-	-
5	-	-	-	-	-	-	-	-	-	**2**	-	-
6	-	-	-	-	-	-	-	-	-	**2**	-	-

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

Subject Code	21CMMAT1010/1020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

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

Unit -1	**Hours**
Differential Equations of first order and first degree : Linear differential equations - Bernoulli's equations – Exact	**10**

equations and Equations reducible to exact form. Applications: Newton's law of cooling - Law of natural growth and decay - Orthogonal trajectories.	
Unit -2	
Linear differential equations of higher order: Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^n V(x) – Method of Variation of parameters. Applications: LCR circuit.	**10**
Unit – 3	
Partial differentiation: Introduction – Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method.	**10**
Unit – 4	
PDE of first order: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.	**08**
Unit – 5	
Multiple integrals: Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates. Applications: Finding Areas and Volumes.	**12**
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	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	-	-	-	-	-	-	-	-	-	-
2	3	3	-	-	-	-	-	-	-	-	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-
4	3	3	-	-	-	-	-	-	-	-	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-
Course	3	3	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING SEMESTER I/ II **(Common to All)**			
Subject Code	21CMEET1030/2030	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 -1z	**Hours**
Basic Electrical Circuits: Basic definitions(Electric Charge, Current, Electro Magnet Force, Potential Difference; Electric Power and Energy) – types of network elements – Ohm's Law – Kirchhoff's Laws –series & parallel circuits - network theorems (Super position, Thevinen's, Norton's, Maximum power transfer theorems)	**10**
Unit -2	
AC Fundamentals & Basic Electromagnetic Laws: Study of AC Voltage and Current, RMS and Average Values, Three phase Star-Delta connections, Alternating Voltage applied to Pure	**10**

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,	
Unit – 3	
DC Machines: DC Machine -Principle of operation & construction – emf equation- torque equation - speed control methods – losses and efficiency – brake test. Applications of DC motors.	**10**
Unit – 4	
AC Machines: Single Phase Transformers - Construction and Operation- Principles - Classification - Applications-OC & SC test of single phase transformer-regulation & Efficiency. Three Phase Induction Motors: working principle- construction, speed- torque characteristics-losses and efficiency.	**10**
Unit – 5	
Electrical Safety: Electrical Shock and Precautions against it, Treatment of Electric Shock; Concept of Fuses and Their Classification, Selection and Application; Concept of Earthing.	**10**
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.	
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: 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
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**									

PROGRAMMING FOR PROBLEM SOLVING SEMESTER I (Common to All)			
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,conditionalstatements, loops and functions.
- To be familiarized with general coding techniques and procedure-oriented programming.

Unit -1	**Hours**
History & Hardware: (TB 1: 1-22) Computer Hardware, Components, Types of Software, Memory Units.**Introduction to Problem solving**: (TB1:33-50) Algorithm, Characteristics 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 -2	
Overview of C: (TB:68-125) Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator Precedence and Associativity, 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:**	**10**

(TB1:174-175) go to**. Control flow Statements:** break, continue**. Looping Constructs:** (TB1:156-170) do-while statement, while statement, for statement	
Unit -3	
Arrays: (TB1:188-222) Introduction,1-DArrays,Character arrays and string representation, 2-D Arrays(Matrix), Multi-Dimensional Arrays. **Strings**: Working with Strings, String Handling Functions (both library and user defined). **Functions:** (TB1:230-260) Basics, Necessity and Advantages, Types of Functions, Parameter Passing Mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion toIteration and Vice-Versa.	**10**
Unit -4	
Pointers: (TB1:288-347) Understanding Pointers, Pointer Expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memor**y **Allocation:** Introduction to Dynamic Memory Alloca-tion- 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, Self-Referential Structures, Bitfields, Enumerations.	**10**
Unit -5	
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**

COURSE OUTCOMES:

On completion of the course student will be able to

- Demonstrate computer components, algorithms, translate them into programs.
- Choose thesuitable control structures for the problem to besolved.
- Make use of arrays, pointers, structures,and unions effectively.
- Organize reusable code in a program into functions.
- Demonstration of file operations.

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) Programming in C ,Pradip Dey , Manas Ghosh, OXFORD
2) Programming in ,C Reema Thareja,Second Edition, OXFORD
3) Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.

REFERENCE BOOKS:

1) Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.

2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.

Course Outcomes to Program Outcomes Mapping

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 1 0	PO 1 1	PO 1 2	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

COMPUTER AIDED ENGINEERING GRAPHICS (Common to AI&M, CSE, CST,ECE,ECT & IT)			
Subject Code	221AMMEL1050/1ECMEL1050/ 21ETMEL1050/21CSMEL1050/ 21CTMEL1050/21ITMEL1050	IA Marks	30
Number of Lecture Hr/W	1(L)+0(T)+4(P)	Exam Marks	70
Total Number of Leccturer Hr	50	Exam Hours	3

Credits – 03

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

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

Unit -1: INTRODUCTION	**Hours**

Introduction to Engineering Graphics, sheet sizes & layouts (ISO), line types with application, scales, drawing sheet sizes, title block, sheet markings, dimensioning

AutoCAD: Overview of Computer Graphics, starting with auto CAD, 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

COURSE OUTCOMES TO PROGRAM UTCOMES MAPPING:

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	2									3				
3	2									3				
4	2									3				
5	2				3					3				3
Overall	2				3					3				3

ENGINEERING GRAPHICS (Common to CE,EE &ME)			
Subject Code	21CEMET1050/21EEMET1050 21MEMET1050	IA Marks	30
Number of Lecture Hr/Wk	1(L)+04(P)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES: On successful completion of the course, **s**tudents should be able to

1. construct polygons, scales, engineering curves (parabola, ellipse, hyperbola, cycloids, involutes)
2. draw orthographic projections of points, lines and planes.
3. draw the orthographic projections of simple solids
4. draw sectional views of solids
5. convert given isometric view into orthographic view and vice versa using AutoCAD software.

Unit -1	**Teaching Hours**
Introduction to Engineering Drawing covering Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (Eccentricity method only); plain Cycloid, and Involutes; Scales – Plain and Vernier scales only.	10
Unit -2	
Projections of Points, Projections of straight lines and the line inclined to bothplanes; Projections of planes (inclined to one reference plane only).	08
Unit – 3	
Projections of regular polyhedrons – tetrahedron, hexahedron, octahedron (axis inclined to one reference plane only).Projections of irregular polyhedrons – Prisms, Pyramids, Cones and Cylinders(axis inclined to one reference plane only).	08
Unit – 4	
Sectional Views of Right Angular Solids covering Prism, Cylinder, Pyramid andCone	12
Unit – 5	
Introduction to AutoCAD - The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension Tools), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and Windows. Isometric Projections, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids;Conversion of Isometric Views to Orthographic Views and Vice-versa.	12

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

1. construct polygons, scales and engineering curves
2. draw the orthographic views of points, lines and planes
3. construct the projections of regular and irregular polyhedrons
4. draw the sectional views of solids
5. draw isometric/orthographic views using AutoCAD

Text/Reference Books

1. N.D. Bhatt, Engineering Drawing, Charotar Publications
2. R.B.Choudary, Engineering Drawing, Anuradha Publishers
3. Agarwal & Agarwal, Engineering Drawing, Tata McGraw Hill Publishers
4. K.L.Narayana & P.Kannaiah, Engineering Drawing, Scitech Publishers
5. K.C. John, Engineering Graphics for Degree, PHI Publishers
6. PI Varghese, Engineering Graphics, Mc GrawHill Publishers
7. K Venugopal, V. Prabhu Raja, Engineering Drawing + AutoCAD, New Age

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 1 0	PO 1 1	PO 1 2	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
(Semiconductor Physics & Semiconductor Optoelectronics)
(Common for AI&MLCSE,CST,EEE&IT)

Subject Code	21AMAMT1020/21CTPHT1020/21EEPHT2020/21CSPHT2020/ 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 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	PO11	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 PHYSICS (Introduction to Mechanics)			
Subject Code	21CEPHT2020 21MEPHT2020	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 explore** the knowledge of fundamental vibrations. • **To impart** the concept of Newton's law of motion in central force field. • **To enable** the students to understand the Rigid body dynamics. • **To study** the structure- property relationship exhibited by solid materials with in the elastic limits.			
Unit -1			
One Dimensional motion: Newton's Equation of motion in one dimension-examples of particle falling under a gravity, Simple harmonic motion (Mechanical oscillator) and its characteristics, Damped harmonic motion (Mechanical oscillator) and damping conditions (over-damped, critically damped and under damped conditions), Forced oscillations (Mechanical oscillator) - un damped and damped conditions, Resonance.			**11**

Unit -2	
Two dimensional motions: Two Dimensional motion in the Cartesian coordinate system – Example of Projectile motion without air drag; Two Dimensional motion in Radial polar coordinate system- Example of planetary motion, Kepler's laws and their deduction, Newton equations for variable mass system (rocket), Calculations of Centre of mass and its characteristics .	**11**
Unit -3	
Conservative & Non Conservative motion: Invariance of Newton's equations-Under shift of coordinate system - Galileo transformation - Accelerating frames of reference, Reference frame rotating with a constant angular velocity, Centrifugal Force-Apparent gravitational acceleration, Coriolis force -Effect of Coriolis force on a freely falling body. Conservative and Non Conservative forces.	**09**
Unit – 4	
Rigid body dynamics: Angular momentum of a single particle and system of particle, conservation of angular momentum; Equation of motion of a rigid body; Kinetic energy of a rigid rotating body; Moment of Inertia, Calculations of moment of inertia-Rectangular lamina and Uniform cylinder (rod, circular disc); Parallel axis theorem and perpendicular axis theorem and their applications; Euler's equation describing rigid body motion.	**10**
Unit – 5	
Elasticity: Stress, Strain, Hook's law, stress strain curve, generalized Hook's law with and without thermal strains for isotropic materials, Factors affecting the elastic behavior, energy stored per unit volume in stretched wire, different types of moduli and their relations, bending of beams, Bending moment of a beam, Depression of cantilever.	**09**
COURSE OUTCOMES: On completion of the course student will able to 1. **Distinguish** the various harmonic motions and resonance. 2. **Apply** Newton's law of motion to understand the motions of mechanical systems. 3. **Verify** the invariance of Newton's equation of motion. 4. **Understand** the concept of conservative and non-conservative motions. 5. **Formulate** the rigid body dynamics. 6. **Study** the structure- elastic property correlation under load within the elastic limits.	
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. Introduction to Mechanics — MK Verma. 2. A Text Book of Engineering Physics- M.N.Avadhanulu, 11e , S.CHAND,	
REFERENCE BOOKS: 1. S.L Gupta& D.L. Gupta, Unified physics 2. An Introduction to Mechanics — D Kleppner & R Kolenkow 3. Principles of Mechanics — JL Synge & BA Griffiths. 4. Engineering Physics- Ch. Srinivas, Ch. Sesubabu Cengage	

learning.

WEB SOURCES:

1. W1: http://www.physics.org/news.asp
2. W2: http://www.phys.lsu.edu/newwebsite/lecturedemo/
3. W3: http://www.nptl.ac.in
4. W3: American Association of Physics Teachers [http://www.aapt.org/]
5. W3: Society of Physics Students [http://www.aip.org/education/sps/sps.htm]

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
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 PHYSICS (Introduction to Electromagnetic Theory)			
Subject Code	**21ETPHT1020/21ECPHT2020**	IA Marks	30
Number of Lecture HR/Week	03	Exam Marks	70
Total Number of Lecture Hr	50	Exam Hours	03
		Credits – 03	

COURSE OBJECTIVES:

The objectives of this course, help the students:

- **To impart** the knowledge of Electrostatics and Magneto statics in vacuum and in dielectric medium.
- **To impart** the knowledge of Maxwell's equations to understanding the propagation of EM waves.

Unit -1	**Hours**
Electrostatics in vacuum: Coulomb's law, Electrostatic field (E) and Electrostatic potential or Scalar potential (V) due to a point charge, Equipotential surfaces, Relation between E&V, Gauss law in electrostatics, Applications of Gauss law-Calculation of Electric field strength and potential due to the uniform charge distribution over a (i) wire (ii) sheet (c) solid sphere and (e) solid cylinder, Divergence and Curl of electrostatic field, Energy of a discrete and continuous charge distribution.	**10**

Unit -2	
Electrostatics in dielectric medium: Electrostatic field and potential due to a Electric dipole, Types of dielectrics, Electric displacement (D), Dielectric polarization (P), Dielectric polarizability, Susceptibility and Dielectric constant, Relation between D, E and P, Bound charge due to electric polarization, Boundary conditions at interface of dielectric media, Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius-Mossotti equation.	**10**
Unit – 3	
Magneto statics: Biot- Savart's law, Magnetic field due to long straight current carrying conductor, Magnetic field on the axis of a current loop, Helmholtz coils, Magnetic field induction due to a solenoid, Divergence of magnetic field (Gauss law in magneto statics), Curl of Magnetic field (Ampere's circuital law); Magnetic Scalar and Vector potential, Motion of charged particle in electrical field and in a magnetic field, Hall effect.	**11**
Unit – 4	
Electromagnetic induction: Electromotive force, Faradays laws of electromagnetic induction, Differential form of Faraday's law, motional EMF; Relation between electric potential and magnetic vector potential using faraday's law, Lenz's law, Self-inductance of Solenoid, Energy density stored in an inductor, Continuity equation for current densities; Displace current; Modified Amperes circuital law.	**10**

Unit – 5	
Maxwell's equations and EM waves: Maxwell's equation in vacuum and non-conducting medium; Wave equation of EM waves; Plane electromagnetic waves in vacuum, their transverse nature; Relation between electric and magnetic fields of an electromagnetic wave; Energy density in EM fields, Pointing Theorem, polarization of EM waves, Momentum carried by electromagnetic waves and radiation pressure.	**9**

COURSE OUTCOMES:

On completion of the course student will able to

1. **Formulate** the electric field and electric potential using fundamental laws in electrostatics.
2. **Understand** the microscopic behavior of dielectrics in electrical field**.**
3. **Calculate** the static magnetic fields due to current carrying conductors.
4. **Estimate** the physical parameters of a system using the basic laws of electricity and magnetism.
5. **Recognize** the relation between electrical fields and time varying magnetic fields.
6. **Apply** Maxwell's equations for the propagation of EM waves.

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. Saroj K. Dash, Smaruti R. Khuntia, Fundamentals of Electromagnetic theory.
2. David Griffiths, Introduction to Electrodynamics.

REFERENCE BOOKS:

1. W. Saslow, Electricity, magnetism and light.
2. S.L Gupta& D.L. Gupta, Unified physics.
3. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning.

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**
1	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
4	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Course	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ENGINEERING CHEMISTRY			
Subject Code	21CMCHT1030/ 21CMCHT2030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Explain the mechanism of corrosion
2. Interpret various boiler troubles and importance of water quality standards.
3. Learn preparation of semiconducting materials, nano materials 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.

Unit -1	**Hours**
Electrochemistry and Corrosion **Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. **Corrosion:** Introduction, Mechanism of Wet chemical corrosion, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	**9**
Unit -2	
Water Chemistry and Surface Properties **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, Hardness of water, Temporary and Permanent hardness, Units, determination of hardness by complexometric method. Boiler troubles, Caustic Embrittlement, Priming and foaming, Boiler corrosion. Break point chlorination. **Surface properties:** Determination of surface tension and viscosity of liquids.	**9**
Unit -3	
Material Chemistry **Non-elemental semiconducting materials:** Stoichiometric, controlled valency and chalcogen photo/semiconductors and preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion and ion implantation). **Liquid crystals:** Introduction, types and applications. **Nanoparticles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – Preparation of carbon nanotubes (Arc discharge, chemical vapour deposition and laser ablation methods) properties and applications.	**10**
Unit -4	

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

COURSE OUTCOMES:

On completion of the course student will be able to

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:

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

ENGINEERING MATHEMATICS-II (Linear algebra, Laplace transforms & Numerical Methods) Common to all the branches			
Subject Code	21CMMAT2010/2010	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:

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	**Hr**

Solving systems of linear equations: Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non homogeneous linear equations – Gauss Elimination method- Jacobi and Gauss-Seidel methods for solving system of equations numerically.	**10**

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

Course outcomes:

On completion of this course, students are able to,

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

PYTHON PROGRAMMING Common to All SEMESTER II			
Subject Code	21CMCST2040	Internal Marks	30
Number of Lecture Hours/Week	1	External Marks	70
Total Number of Lecture Hours		Exam Hours	03
Pre-requisite		Credits – 03	

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, conditionalstatements, loops and functions. • To be familiarized with general coding techniques and object-oriented programming andGraphical User Interfaces.	
Unit -1	**Hours**
Introduction:(TB1:22-30,TB2:1.1-1.4,TB2:1.21-1.33) Introduction Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Variables, Reading Input fromthe Keyboard, Operators. **Data Types, and Expression: (TB1:41-59)** Strings Assignment, and Comment, Numeric Data Types andCharacter Sets, Type conversions, Expressions, Using functions and Modules. **Decision Structures and Boolean Logic:(TB1:77-85)** if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.	08

Unit -2	
Control Statement:(TB1:65-72, TB1:86-91) Definite iteration for Loop Formatting Text for output, Selection if and if else Statement ConditionalIteration, 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.	10
Unit -3	
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 a File System. **Modules**: **(TB2:8.1-8.5)** Modules, Standard Modules, Packages.	12
Unit – 4	
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, CaseStudy an ATM.	12
Unit – 5	
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:

On completion of the course student will be able to

- Able to learn the fundamental concepts in the Python language
- Implementation of python iterative statements and strings
- Demonstrate python lists, dictionaries and functions
- Understand the concepts of modules and packages in python
- Complete coding challenges relating to object-oriented programming's essential concepts and techniques.
- Apply variety of error handling and GUI programming techniques

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. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

E-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf

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	PS O1	PS O2	PS O3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
3	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3
4	3	2	3	-	3	-	-	-	-	-	-	-	-	-	2
5	3	3	3	-	2	-	-	-	-	-	-	-	-	-	2
6	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3
Course	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

NETWORK ANALYSIS			
Subject Code	21ECECT2050/ 21ETETT2050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite		Credits – 03	

COURSE OBJECTIVES:

- To understand the basic concepts on RLC circuits.
- To know the behavior of the steady states and transients states in RLC circuits.
- To know the basic Laplace transforms techniques in periods' waveforms.
- To understand the two port network parameters.
- To understand the properties of LC networks and filters.

Unit -1	**Hours**
Fundamentals and Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule. Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor-problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples.	08
Unit -2	
Electric Circuits: Review of Kirchhoff's laws, Mesh analysis and Nodal analysis problem solving including dependent sources also. **Network Theorems:** Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens- problem solving using dependent sources also.	10
Unit -3	
Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L- C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving. **Transients:** First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method.	12
Unit – 4	
Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general case-resistance present in both branches, anti resonance at all frequencies. **Coupled Circuits:** Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits,	12

Natural current, Dot rule of coupled circuits, Conductively coupled equivalent circuits- problem solving.	
Unit – 5	
Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.	8
Course outcomes: On completion of the course student will be able to 1. Gain the knowledge on basic network elements. 2. Will analyze the RLC circuits' behavior in detailed. 3. Analyze the performance of periodic waveforms. 4. Gain the knowledge in characteristics of two port network parameters (Z,Y,ABCD,h&g). 5. Analyze the filter design concepts in real world applications.	
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. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rdEdition,2000. 2. Network Analysis by K.Satya Prasad and S Sivanagaraju,CengageLearning 3. Electric Circuit Analysis by Hayt andKimmarle,TMH	
Reference Books: 1. Network lines and Fields by John. D. Ryder 2ndedition, Asiapublishinghouse. 2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers. 3.Network Analysis and Filter Design by Chadha,UmeshPublications.	

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	PS O1	PS O2	PS O3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
3	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3
4	3	2	3	-	3	-	-	-	-	-	-	-	-	-	2
5	3	3	3	-	2	-	-	-	-	-	-	-	-	-	2
6	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3
Cour	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

se															

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1.	Fundamentals and Network Topology	T2 &R1	1
2.	Electric Circuits and Network Theorems	T2&R1	2 &3
3.	Steady State Analysis of A.C Ckts &Transient	T2,T1,R2	4,5 &6
4.	Resonance and Coupled Circuits	T2,R2	6,7& 8
5.	Two-port Networks	T1	4 & 5

DATA STRUCTURES
Common to AI&ML,CSE.CST&IT)

Subject Code	21CSAMT2050/21CSCST2050 21CSCT2050/21ITITT2050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite		Credits – 03	

COURSE OBJECTIVES:

- 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 -1	**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.	08
Unit -2	
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.	10
Unit -3	
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	12

Conversion, Evaluating Postfix Expressions.	
Unit – 4	
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.]	12
Unit – 5	
Graphs: (TB1: 383-419) Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims &Kreskas Algorithm, Dijkstra's shortest path, Transitive closure, Wars hall's Algorithm.	8

Course outcomes:

After completing this course a student will be able to:

- Discuss the Basics of data structures and computational efficiency of algorithms for sorting & searching.
- Illustration of linked lists and its operations.
- Design programs using a variety of data structures such as stacks and queues.
- Demonstrate different tree traversing method.
- Describing the graphs concepts.

Question paper pattern:

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

Text Books:

- Data Structures Using C. 2nd Edition. Reema Thareja, Oxford.
- Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss

Reference Books:

- Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
- Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A.Forouzon, Cengage.
- Data Structures with C, Seymour Lipschutz TMH

e-Resources:

- http://algs4.cs.princeton.edu/home/
- https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

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
1	3	3	3									2		2
2	3	3	3									2		2
3	3	3	3									2		2
4	3	3	3									2		2
5	3	3	3									2		2
Course	**3**	**3**	**3**									**2**		**2**

ENGINEERING MECHANICS			
Subject Code	21CEMET2050/21EEMET2050 21MEMETT2050	IA Marks	
Number of Lecture Hours/Week	3(L)	Exam Marks	
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 03

Course objectives

On successful completion of the course, the students should be able to

1. understand the effect of forces and moments on the solid rigid bodies
2. analyze static problems using free body diagrams by considering friction.
3. locate centroid and calculate moment of inertia for different cross sections.
4. calculate velocity and acceleration of particles having rectilinear motion and rotation
5. analyze dynamic problems using work energy method and impulse-momentum method.

Unit -1	**Hours**

Introduction to engineering mechanics: Basic terminologies in mechanics, laws of mechanics, characteristics of force, system of force. **Resultant system of forces**: Resolution of forces, method of composition of forces, resultant of coplanar concurrent force system, moment of a force and couple. **Friction:** Frictional force, laws of Coulomb friction, angle of friction, limiting friction and angle of repose, problems on blocks resting on horizontal and inclined planes.	10 Hours

Unit -2	
Equilibrium of system of forces: Equilibrium of a rigid body subjected to coplanar concurrent forces and coplanar non-concurrent forces, free body diagrams, Lami's theorem, equilibrium of connected bodies.	9 Hours
Unit – 3	
Centroid and centre of gravity: Centre of gravity, centroid, use of axis symmetry determination of centroid of simple figures from first principles, centroid of composite sections. **Moment of inertia**: Moment of inertia, polar moment of inertia, theorems of moment of inertia, moment of inertia of rectangle, triangle, circle, semi circle, quarter circle from first principles, moment of inertia of L, T and I sections only. Mass moment of inertia, radius of gyration, mass moment of inertia of uniform rod, rectangular plate and circular plate only.	12 Hours
Unit-4 **Kinematics:** General principles in dynamics, types of motion, rectilinear motion, motion curves, motion with uniform velocity, motion with uniform acceleration, motion with varying acceleration, angular motion, relationship between linear and angular motions. **Kinetics:** Bodies in rectilinear translation, kinetics of bodies rotating about fixed axes, Newton's second law of motion, D-Alembert's principle.	10 Hours
Unit - 5 Work-Energy Method: Equation of Translation, work energy application to particle motion, connected system - Fixed axis rotation and plane motion, Impulse momentum method.	9 Hours
Course outcomes On completion of this course, students will be able to 1. Determine resultant force and moment for different force systems. 2. analyse the rigid bodies associated with frictional forces using conditions of equilibrium 3. Locate the centroid / center of gravity and determine the moment of inertia of plane sections/solids. 4. Understand the behavior of moving bodies in rectilinear motion and solve kinematic equations of motion curves. 5. Solve the problem using work energy method and impulse momentum method.	
Text Books 1. S.S. Bhavikatti and K.G. Rajashekarappa, Engineering Mechanics, New Age, 2012. 2. N.H. Dubey, Engineering Mechanics, Mc Graw Hill, 2012	
Reference Books 1 F. L. Singer, Engineering Mechanics, Harper–Collins, 1994 2. B. Bhattacharya, Engineering Mechanics, Oxford University Press, 2008 3. A.K.Tayal, Engineering Mechanics, Umesh Publications, 2012. 4. R.K.Bansal, Engineering Mechanics, Laxmi Publications, 1996. 5. R.K.Rajput, A Text book of Applied Mechanics, Laxmi Publications, 2011. 6. S.Timoshenko and D.H.Young, Engineering Mechanics, 4th Ed. , Mc Graw Hill	

7. A.Nelson, Engineering Mechanics - Statics and Dynamics, TMG, New Delhi, 2009.

WEB REFERENCES

W1. https://nptel.ac.in/courses

W2. http://learnmech.com/

COs vs. POs MAPPING (high: 3; medium: 2; low: 1)

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2				1							1	
CO2	1	2				1							1	
CO3	1	2				1							1	
CO4	1	3				1							1	
CO5	1	2				1							1	
Overall Level of mapping	**1**	**2**				**1**							**1**	

Practical Examination Evaluation Procedure Internal:15 Marks

1.Continuous Evaluation by submitting the Record book for every experiments:05

2. Conduct the internal examination at the end of the semester:10

Practical Examination at the time of final Examination:35

Question paper pattern:

Ten questions are given, and student should choose one question (blind option), which carries 50 marks in total.

1. 10 marks are allotted for procedure.
2. 10 marks for conduction of the experiment.
3. 05 marks for results and conclusions.

10 marks for viva voce

ENGLISH LANGUAGE COMMUNICATION SKILLS LAB			
Subject Code	18CMEGL1050/ 2050	IA Marks	
Number of Practical Hr./week	02	Exam Marks	
Total Number of Practical Hr	32	Exam Hours	
Credits – 01			

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
- Presentation Skills

List of Experiments

UNIT I: Listening Comprehension

UNIT II: Pronunciation , Stress, Intonation & Rhythm

UNIT III: Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

UNIT IV: Interpersonal Communication Skills- Group discussions and debates

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:

- Listening Comprehension, Pronunciation, Dialogues, Interpersonal Communication Skills ,Presentation Skills &Discussions and Debate

Learning Resources:

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

Course Outcomes Vs Program Outcomes Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	-	-	-	-	-	-	-	-	-	2	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-

BASIC ELECTRICAL ENGINEERING LABORATORY (Common to All)			
Subject Code	21CMEEL1070/ 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 Kirchhoff'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 OUTCOMES:

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 earthling's

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

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1			2												
CO2			2												
CO3			2												
CO4			2												

CO5			2												
CO6			2												
Overall Course			**2**												

PROGRAMMING FOR PROBLEM SOLVING LAB

(Common to All)

SEMESTER I

Subject Code	21CMCSL1080	Internal Marks	15
Number of Lecture Hours/ Week	3	External Marks	35
Total Number of Hours	36	Exam Hours	03

Credits – 1.5

Course Objectives:

This course will enable students to

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.

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 =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, shiftoperator 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, performsthe operation & 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 theuser.

c) Write a C Program to print the multiplication table corresponding to number supplied as input

Exercise 5 (Iterative problems)

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

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

Exercise 6 (Series examples)

a) Write a C Program to calculate sum of following series

b) 1+2+3+…. n b) 1+1/2+1/3+……+1/n c)1+x+x2+x3……+xn

Exercise 7 (1D Array manipulation)

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

Exercise 8 (Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message
"Incompatible matrix sizes" otherwise.
c) Write a C program to check given matrix is symmetric or not.

Implement the following string operations with and without library functions. i)copy ii) concatenate iii) length iv) compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
b) With arguments and with return value.
c) With arguments and without return alue
d) Without arguments and without return value.
e) Without arguments and with return value.
f) 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 programto 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.

Text Books:

1. Computer Programing ANSI C, E Balagurusamy, Mc Graw Hill Education(Private), Limited (TB1)
2. Programming in C, ReemaThareja, Second Edition, Oxford Higher Education (TB2)

Reference Books:

1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI (RB1) Course Outcomes:
2. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step- wise refinement.
4. Demonstrate conversion of iterative functions to recursive and vice-versa.
5. Implement the concepts of arrays, structures, Unions and files.

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 1 2**	**PSO 1**	**PSO 2**
1	3	3	3										3	
2	3	3	3		2								3	
3	3	3	3		2								3	
4	3	3	3		2								3	
5	3	3	3		2								3	
Course	**3**	**3**	**3**		**2**								**3**	

ENGINEERING PHYSICS LAB
(Common to AI &ML,CSE,CST,EEE & IT)

Subject Code	21AMPHL1060/21CTPHL1060/ 21EEPHL1060 21ITPHL2060/21CSPHL2060	IA Marks	15
Number of Practice Hours/Week	03	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
		Credits – 1.5	

COURSE OBJECTIVES:

The objectives of this course, help the students

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

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

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

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

C

OURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	P O2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
4	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Cours e	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ENGINEERING PHYSICS LAB (Common for ECE &ECT)			
Subject Code	21ETPHL1060/ 21ECL2060	IA Marks	15
Number of Practice Hours/Week	03	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
		Credits – 1.5	

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To apply** the theoretical knowledge of Physics through hands on the experimental instruments
- **To improve** the experimental knowledge in the later studies
- **To understand** the basic need of experiment**s.**
- **To know** how to measure the different physical quantities.
- **To acquire** ability to use instrumentation techniques.
- **To train** the students to develop techniques based on the principles related to various devices or components.

List of Experiments

1. Determination of the dielectric constant of the dielectric material in the given capacitor using a RC charging and discharging circuit.
2. Measuring of the magnetic field induction of circular coil-Stewart-Gee's experiment.
3. Determination of the horizontal component of earth magnetic field using Helmholtz coil galvanometer..
4. Study of the motion of charged particle in electric and magnetic fields and determine the value of e/m by magnetic focusing.
5. Determination of the frequency of the AC Source using Sonometer.
6. Determination of the electromotive force (emf) of an unknown cell using a stretched wire potentiometer.
7. Study of the particle behavior of EM wave and estimation of Planck's constant using photocell.
8. Determination of the frequency of electrical vibrator-Melde's experiment.
9. Determination of the wavelength and frequency of the electromagnetic wave using diffraction.
10. Verification of laws of transverse waves in a stretched string.

Demonstration experiments:

1. Estimation of Hall coefficient and estimate the concentration of charge carriers using Hall Effect.
2. Determination of the self inductance and resistance of a coil with air core.

COURSE OUTCOMES:

On completion of the course student will able to

7. **Compare** the theory and correlated with experiments
8. **Design** experiments
9. **Analyze** the experimental result
10. **Apply** appropriate techniques to perform the experiments
11. **Apply** the fundamental laws in electromagnetism to understand the behavior of electromagnetic fields.
12. **Calculate** the frequency and wavelength of EM Waves**.**

Question paper pattern:

Ten questions are given, and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.

b. 15 marks for conduction of the experiment.

c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

TEXT BOOKS:"*Physics Laboratory Manual"* Prepared by Department of Physics, SITE.

REFERENCE BOOKS:

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

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

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 PHYSICS LAB (Common CE & ME)			
Subject Code	21CEPHL1060/21MEPHL1060	IA Marks	15
Number of Practice Hr/Week	03	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
		Credits – 1.5	

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To apply** the theoretical knowledge of Physics through hands on the experimental instruments
- **To improve** the experimental knowledge in the later studies
- **To understand** the basic need of experiments.
- **To know** how to measure the different physical quantities.
- **To acquire** ability to use instrumentation techniques.
- **To train** the students to develop techniques based on the principles related to various devices or components.

List of Experiments

1. Investigation of the Motion of Coupled Oscillators.
2. Determination of the rigidity modulus η of wire-Torsional pendulum.
3. Determination of acceleration due to gravity *g* and radius of gyration *K* - Compound pendulum.
4. Determination of the Frequency of an electrically maintained tuning fork by Melde's Experiment.
5. Determination of the velocity of sound in air-Volume resonator.
6. Verification of the laws of transverse vibrations of stretched wire.
7. Determination of the Young's modulus and draw load depression graph in uniform bending.
8. Determination of the Moment of Inertia of a Flywheel.
9. Verification of the parallel axis and perpendicular axis theorems and determine the moment of inertia of a regular rectangular body -Bifilar pendulum.
10. Determination of the frequency of the AC Source using Sonometer.

Demonstration experiments:

1. Determination of Young's Modulus, Modulus of rigidity and Poisson's ratio of the material of a given wire by Searle's dynamical method
2. Study of the variation of moment of inertia of a system with the variation in the distribution of mass and hence to verify the theorem of parallel axes (Maxwell' needle method).

TEXT BOOKS:

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

REFERENCE BOOKS:

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

WEB SOURCES:

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

COURSE OUTCOMES:

On completion of the course student will able to

13. **Compare** the theory and correlated with experiments
14. **Design** experiments
15. **Analyze** the experimental result
16. **Apply** appropriate techniques to perform the experiments
17. **Apply** the knowledge in simple harmonic motions and resonance to understand the rigid body dynamics**.**
18. **Verify** the parallel axis and perpendicular theorems of moment of inertia**.**

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
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 (Common to All)			
Subject Code	21CMCHL1070/ 21CMCHL2070	IA Marks	15
Number of Practice Hr/Week	3	Exam Marks	35
Total Number of Practice Hr	36	Exam Hours	03
Credits – 1.5			

List of Experiments

(Any 10 experiments must be conducted)

Determination of HCl using standard Na2CO3 solution
Determination of alkalinity of a sample containing Na2CO3 and NaOH
Determination of surface tension
Determination of viscosity of a liquid by Ostwald viscometer
Determination of chloride content of water
Determination total hardness of water by EDTA.
Determination of Mg^{+2}using standard oxalic acid solution.
Determination of Cu^{+2}using standard hypo solution.
Determination of the rate constant of first order reaction (Ester hydrolysis)
Determination of strength of strong acid using conductometeric titration.
Determination of strength of weak acid using conductometeric titration .
Determination of Ferrous iron using potentiometer.
Chemical oscillations- Iodine clock reaction
Estimation of Vitamin C.

Demonstration Experiments

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

Question paper pattern:

Ten questions are given, and student should choose one question (blind option), which carries 50 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
10 marks for viva voce.

DATA STRUCTURES LAB

(Common to AI& ML,CSE,CST&IT)

Subject Code	**2**1AMAMPL2060/21CSCSPL 2060 21CTCTP2060/21ITITP2060	IA Marks	15
Number of Practice Hr/Week	03	Exam Marks	35
Total Number of Practice Hr	36	Exam Hours	03

Credits – 1.5

COURSE OBJECTIVES:

The objectives of this course, help the students

- Demonstrate the different data structures implementation

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
- Making use of basic data structures such as arrays and linked list to solve problems.
- Demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
- Solve various searching and sorting problems.

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
1	3	3	3									2		2
2	3	3	3									2		2
3	3	3	3									2		2
4	3	3	3									2		2

5	3	3	3									2		2
Course	**3**	**3**	**3**									**2**		**2**

ENGINEERING WORKSHOP LAB			
Subject Code	21CEMEL2080/21ECMEL2080 21ETMEL2080/21EEMEL2080/ 21MEMEL2080	IA Marks	15
Number of Lecture Hours/Week	L(0)+T(0)+P(3)	Exam Marks	35
Total Number of Lecture Hours	36	Exam Hours	3

Credits – 1.5

Course objectives: On completion of the course students should be able to

1. Learn basic use of hand tools along with the techniques and methods applicable to the carpentry trade
2. Learn basic use of hand tools along with the techniques and methods applicable to the fitting trade
3. Learn basic use of hand tools along with the techniques and methods applicable to the forging trade
4. Learn basic use of hand tools along with the techniques and methods applicable to the casting trade
5. Learn basic use of hand tools along with the techniques and methods applicable to the welding trade

EXPERIMENTS

1. Preparation of T Lap joint using carpentry.
2. Preparation of Cross Lap joint using carpentry.
3. Preparation of Square fit using mild steel specimen.
4. Preparation of V fit using mild steel specimen.
5. Conversion of round rod to square rod by forging operation.
6. Preparation of *S* hooks by forging operation.
7. Preparation of green sand mould for a single piece pattern
8. Preparation of green sand mould for a split piece pattern
9. Preparation of a Butt joint using arc welding
10. Preparation of a Lap joint using arc Welding

ADDITIONAL EXPERIMENTS

1. Preparation of electrical wiring connections using wiring (one lamp controlled by one switch)
2. Preparation of house wiring (stair case wiring)

Course outcomes: On successful completion of this course, the students will be able to

1. Perform the joinery work of wooden pieces using carpentry.
2. Perform the joinery work of metallic pieces using fitting.
3. Produce the required shaped metallic products using black smithy.
4. Make the green sand moulds using different patterns
5. Fabricate different components using welding.

Question paper pattern:
Ten questions are given, and student should choose one question (blind option), which carries 50 marks in total.
a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

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

COs / POs	**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**
CO1	2								2					
CO2	2								2				2	
CO3	2								2				2	
CO4	2								2				2	
CO5	2								2					
CO6	1								1				1	
Course	**2**								**2**				**2**	

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS (Common to all Branches)			
Subject Code	21CMMSN1090/ 21CMMSN2090	IA Marks	30
Number of Lecture Hr/week	03	Exam Marks	70
Total Number of Lecture Hr	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	**Hours**
Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**10**
Unit - II	
Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**10**
Unit – III	
State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**10**
Unit –IV	
Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	**10**
Unit – V	
Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**10**

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:

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. 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, 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

ENVIRONMENTAL SCIENCE			
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

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

and Ex-situ conservation of biodiversity.	
Unit – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution c. Soil pollution d. Noise pollution e. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.	**6**
Unit – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act .	**6**

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:

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. 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
1	-	-	-	-	-	-	3	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	2	-	-	-	2	-	-	-	-	-

COURSE STRUCTURE for B. Tech
Semester I (First year)

S.No	Category	Subject Code	Course	Hours			Credits
				L	T	P	
1	HS	21CMEGT1010	Technical English	3	0	0	3
2	BS	21CMMAT1020	Engineering Mathematics – I	3	0	0	3
3	ES	21CMEET1030	Basic Electrical Engineering	3	0	0	3
4	ES	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	ES	21CSNEL1050	Computer Aided Engineering Graphics	2	0	2	3
6	HS	21CMEGL1060	English Communication Skills Lab	0	0	3	1.5
7	ES	21CMEEL1070	Basic Electrical Engineering Lab	0	0	3	1.5
8	ES	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	MC	21CMESN1090	Environmental Science	2	0	0	0
			TOTAL	16	0	11	19.5

Category	CREDITS
Basic Science Courses	3.0
Humanities Science Courses	4.5
Engineering Science courses	12.0

TOTAL CREDITS	19.5

Semester II (First year I -II)

S. No	Category	Subject Code	Course	Hours			Credits
				L	T	P	
1	BS	21CMMAT2010	Engineering Mathematics - II	3	0	0	3
2	BS	21CSPHT2020	Engineering Physics	3	0	0	3
3	BS	21CMCHT2030	Engineering Chemistry	3	0	0	3
4	ES	21CMCST2040	Python Programming	1	0	4	3
5	ES	21CSCST2050	Data Structures	3	0	0	3
6	BS	21CSPHL2060	Engineering Physics Lab	0	0	3	1.5
7	BS	21CMEEL2070	Engineering Chemistry Lab	0	0	3	1.5
8	ES	21CSCSL2080	Data Structures Lab	0	0	3	1.5
9	MC	21CMMSN2090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
			TOTAL	16	0	11	19.5

Category	CREDITS
Basic Science Courses	12.0
Engineering Science courses	7.5
TOTAL CREDITS	19.5

Semester III (Second year II-I)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	BS	21CAMAT3010	Probability Distributions & Statistical Methods	3	0	0	3
2	HS	21CMMST3020	Engineering Economics and Financial Management	3	0	0	3
3	ES	21CACAT3030	Digital Electronics & Computer Organization	3	0	0	3
4	PC	21CACAT3040	Java Programming	3	0	0	3
5	PC	21CACAT3050	Introduction to AI&ML	3	0	0	3
6	PC	21CACAL3060	Digital Electronics & Computer Organization Lab	0	0	3	1.5
7	PC	21CACAL3070	Java Programming Lab	0	0	3	1.5
8	ES	21CACAL3080	Introduction to AI&ML Lab	0	0	3	1.5
9	SOC	21CACAS3090	Web Application Development – I	0	0	3	2
10	MC	21CACAN3100	Intellectual Property Rights	2	0	0	0
			Total credits				21.5

Category	CREDITS
Basic Science Courses	3.0
Professional core Courses	9
Engineering Science Courses	4.5
Humanities and social sciences	3
Skill oriented course	2
TOTAL CREDITS	21.5

Semester IV (Second year II-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	BS	21CAMAT4010	Discrete Mathematics	3	0	0	3
2	PC	21CACAT4020	Data Base Management Systems	3	0	0	3
3	PC	21CACAT4030	Design and Analysis of Algorithms	3	0	0	3
4	PC	21CACAT4040	Automata Theory & Compiler Design	3	0	0	3
5	PC	21CACAT4050	Operating Systems	3	0	0	3
6	PC	21CACAL4060	Data Base Management Systems Lab	0	0	3	1.5
7	PC	21CACAL4070	Operating Systems and LINUX Lab	0	0	3	1.5
8	PC	21CACAL4080	Design and Analysis of Algorithms	0	0	3	1.5
9	SOC	21CACAS4090	Web Application Development–II	1	0	2	2
					Total credits		21.5

Category	CREDITS
Basic Science Courses	3
Professional core Courses	16.5
Skill oriented course	2
Internship	
TOTAL CREDITS	21.5

Semester V (Third year III-I)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CACAT5010	Software Engineering	3	0	0	3
2	PC	21CACAT5020	Data Warehousing and Mining	3	0	0	3
3	PC	21CACAT5030	Computer Networks	3	0	0	3
4	PE	21CACAP504X	Professional Elective -I	3	0	0	3
5	OE	21CAXXO505X	Open Elective - I	3	0	0	3
6	PC	21CACAL5060	Software Engineering Lab	0	0	3	1.5
7	PC	21CACAL5070	Data Mining Lab	0	0	3	1.5
8	SOC	21CMAHS5080	Soft Skills & Aptitude Builder – 1	2	0	0	2
9	PR	21CACAR5090	Summer Internship (Mandatory) after II year (to be evaluated during V Semester)	0	0	0	1.5
10	MC	21CACAN51000	Biology for Engineers	2	0	0	0
					Total credits		21.5

Category	CREDITS
Professional core Courses	12
Open Electives	3
Professional Electives	3
Skill oriented course	2
Summer Internship	1.5
TOTAL CREDITS	21.5

Professional Elective - I	
Code	Course Title
21CACAP504A	Object Oriented Analysis and

	Design
21CACAP504B	Computer Vision
21CACAP504C	DevOps

Semester VI (Third year III-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CACAT6010	Artificial Intelligence	3	0	0	3
2	PC	21CACAT6020	Machine Learning	3	0	0	3
3	PC	21CACAT6030	Big Data Analytics	3	0	0	3
4	PE	21CACAP604X	Professional Elective -II	3	0	0	3
5	PE	21CACAP605X	Professional Elective -III	3	0	0	3
6	OE	21CAXXO606X	Open Elective - II	3	0	0	3
7	PC	21CACAL6070	Machine Learning Lab	0	0	3	1.5
8	SOC	21CMAHS6080	Soft Skills & Aptitude Builder – 2	2	0	0	2
9	MC	21CACAN6090	Essence of Indian Traditional Knowledge	2	0	0	0
						Total credits	21.5

Category	CREDITS
Professional core Courses	10.5
Open Electives	3
Professional Electives	6
Skill oriented course	2
Research Internship	
TOTAL CREDITS	21.5

Professional Elective - II	
Code	Course Title
21CACAP604A	Software Project Management
21CACAP604B	Internet of Things

21CACAP604C	Network Programming

Professional Elective - III	
Code	Course Title
21CACAP605A	Software Quality Assurance
21CACAP605B	Distributed Systems
21CACAP605C	Semantic Web

Semester VII (Fourth year IV-I)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	HS	21CAMST7010	Management Science	3	0	0	3
2	PC	21CACAT7020	Deep Learning	3	0	0	3
3	PE	21CACAP703X	Professional Elective -IV	3	0	0	3
4	PE	21CACAP704X	Professional Elective -V	3	0	0	3
5	OE	21CAXXO705X	Open Elective - III	3	0	0	3
6	OE	21CAXXO706X	Open Elective - IV	3	0	0	3
7	SOC	21CACAS7070	Natural Language Processing with Python	1	0	2	2
8	PR	21CACAR7080	Industrial/ Research internship 2 months (Mandatory) after III year (to be evaluated during VII Semester)	0	0	0	3
					Total credits		23

Category	CREDITS
Professional core Courses	3
Open Electives	6
Professional Electives	6
Humanities and social sciences	3
Skill oriented course	2
Research Internship	3
TOTAL CREDITS	23

Professional Elective – IV	
Code	Course Title
21CACAP703A	Software Testing Methodologies
21CACAP703B	Data Visualisation

21CACAP703C	Cloud Computing

Professional Elective – V	
Code	Course Title
21CACAP704A	Blockchain Technologies
21CACAP704B	NOSQL Databases
21CACAP704C	Reinforcement Learning

Semester VIII (Fourth year IV-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PR	21CACAR8010	Major Project Work	0	0	24	12
						Total credits	12

Category	CREDITS
Project	12
TOTAL CREDITS	12

	BS -21	ES -24	HS-10.5	PC-51	SOC -10	MC -00	OE -12	PE -15	PROJ -16.5	Total
I-I	3	12	4.5			✓				19.5
I-II	12	7.5				✓				19.5
II-I	3	4.5	3	9	2	✓				21.5
II-II	3			16.5	2					21.5
III-I				12	2	✓	3	3	1.5	21.5
III-II				10.5	2	✓	3	6		21.5
IV-I			3	3	2		6	6	3	23
IV-II									12	12
TOTAL	21	24	10.5	51	10		12	15	16.5	160

III SEMESTER (II-I)

Semester III (Second year II-I)

S. No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	BS	21CAMAT3010	Probability Distributions & Statistical Methods	3	0	0	3
2	HS	21CMMST3020	Engineering Economics and Financial Management	3	0	0	3
3	ES	21CACAT3030	Digital Electronics & Computer Organization	3	0	0	3
4	PC	21CACAT3040	Java Programming	3	0	0	3
5	PC	21CACAT3050	Introduction to AI&ML	3	0	0	3
6	PC	21CACAL3060	Digital Electronics & Computer Organization Lab	0	0	3	1.5
7	PC	21CACAL3070	Java Programming Lab	0	0	3	1.5
8	ES	21CACAL3080	Introduction to AI&ML Lab	0	0	3	1.5
9	SOC	21CACAS3090	Web Application Development – I	0	0	3	2
10	MC	21CACAN3100	Intellectual Property Rights	2	0	0	0
			Total credits				21.5

Category	CREDITS
Basic Science Courses	3.0
Professional core Courses	9
Engineering Science Courses	4.5
Humanities and social sciences	3
Skill oriented course	2
TOTAL CREDITS	21.5

Probability Distributions & Statistical Methods			
Subject Code	21CAMAT3010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

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

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

Text Books/ Reference Books:

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

R3	Sheldon M.Ross, Introduction to probability and statistics Engineers and Scientists,4thEdition, Academic Foundation, 2011.
R4	Johannes Ledolter and Robert V.Hogg, Applied Staistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT			
Subject Code	21CMMST3020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	60	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.			14
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).			12
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			10
Unit – 4: Introduction to Accounting & Financing Analysis			
Introduction to Double Entry Systems – Journal entry-Ledger-Trail Balance-Final Accounts-Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis.			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.			12

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

Digital Electronics & Computer Organization			
Subject Code	21CACAT3030	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 course objectives of Computer Organization are to discuss and make student familiar with the

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

UNIT I : Number Systems	Hours
Binary Numbers, Octal and Hexadecimal Numbers, Complements of Numbers, Addition, Subtraction, Logic gates, Map simplification,	10
UNIT II : Digital Electronics Combinatorial Circuits, Flip flips, Decoders, Encoders, Multiplexers	10
Unit-III : Basic Computer Organization and Design Micro operations, Instruction codes, Instruction cycle, Memory Reference & Input Output Instructions, Instruction formats, Addressing modes, Data Transfer & Manipulation, Program Control.	10
UNIT IV : Control Unit Hardwired control unit, Control Memory, Address sequencing, Micro program example, Design of control unit	10
UNIT V Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.	10

Text Books:

1) Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
2) Digital Design, 5/e, M. Morris Mano, Michael D Ciletti, PEA

Reference Books:

1) Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2) Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3) Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006.

Resources:

1) https://nptel.ac.in/courses/106/105/106105163/
   http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf\

Java Programming			
Subject Code	21CACAT3040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			
Unit -1:			Hours
Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -)Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, BitwiseLogical Operators. Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator ?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.			08
Unit -2:			
Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this. Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods,Nesting of Methods, Overriding Methods, Attributes Final and Static.			10
Unit – 3:			
Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Arrays, Arrays as Vectors. Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of			10

Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations..	
Unit – 4:	
Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class. Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.	10
Unit – 5:	
String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder. Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority- Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. Applets: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle,paint(), update() and repaint(). Swing: Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScrollPane, Split Pane, JTabbedPane, Dialog Box, Pluggable Look and Feel.	12

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

Introduction to AI&ML			
Subject Code	21CACAT3050	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 provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. To provide a basic exposition to the goals and methods of Artificial Intelligence.
3. To provide fundamentals of machine learning.

Unit -I: Introduction	Hours
What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	10
Unit -II: Problem Solving	
Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.	10
Unit-III: Knowledge Representation	
Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.	10
Unit –IV:	
Introduction to Machine Learning: Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning. Concept Learning and The General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate-Elimination, Inductive Bias	12
Unit-V: Decision Tree Learning	
Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.	8

Text Books/ Reference Books:	
T1	Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Pearson
T2	Tom M. Mitchell, *Machine Learning,* McGraw Hill Edition, 2013
R1	Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011
R2	Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill

R3	Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.
R4	ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

Digital Electronics & Computer Organization Lab			
Subject Code	21CACAL3060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

1. Verify the truth tables of Logic gates

2. Verify the NAND and NOR gates as Universal logic gates

3. Construct and verify the truth tables of Half and Full adders

4. Construct and Verify the truth tables of Multiplexer and Demultiplexer

5. Construct and test of an SR flipflop and JK flipflop

6 .a) Write a Machine Language Program to perform Addition of two numbers.

b) Write a Machine Language Program to perform Subtraction of two numbers.

7. a) Write a Machine Language Program to perform Addition of n numbers.

b) Write a Machine Language Program to generate n numbers.

8. a) Write a Machine Language Program to generate n Even numbers.

b) Write a Machine Language Program to generate n Odd numbers.

9. a) Write a Machine Language Program to move data from one block to another block.

b) Write a Machine Language Program to mask 4 high-order bits.

10. a) Write a Machine Language Program to read data at location 4400 and unpack data into 07, 0Eand store in 4401 & 4402.

b) Write a Machine Language Program to Find factorial of given number.

11. a) Write a Machine Language Program to Find largest element among two numbers.

b) Write a Machine Language Program to Find smallest element among two numbers.

Java Programming Lab			
Subject Code	21CACAL3070	Internal Marks	15
Number of Tutorial Hours/Week	03(P)	External Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives: This course will enable the students to:

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

Exercise - 1 (Basics)

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

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

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

Exercise - 3 (Class, Objects)

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

Exercise - 4 (Methods)

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

Exercise - 5 (Inheritance)

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi-level Inheritance

c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

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

Exercise - 7 (Exception)

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

Exercise – 8 (Runtime Polymorphism)

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

Exercise – 9 (User defined Exception)

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

Exercise – 10 (Threads)

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

Exercise - 11 (Threads continuity)

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

Exercise – 12 (Packages)

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

Exercise - 13 (Applet)

a Write a JAVA program to paint like paint brush in applet.
b Write a JAVA program to display analog clock using Applet.

c Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

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

INTRODUCTION TO AI&ML LAB			
Subject Code	21CACAL3080	Subject Code	15
Number of Tutorial Hours/Week	03(P)	Number of Tutorial Hours/Week	35
Total Number of Practice Hours	36	Total Number of Practice Hours	03
Credits – 1.5			

List of Experiments (Artificial Intelligence)

1. Implementation of DFS for water jug problem.
2. Implementation of BFS for tic-tac-toe problem.
3. Implementation of TSP using heuristic approach.
4. Implementation of Simulated Annealing Algorithm.
5. Implementation of Hill-climbing to solve 8- Puzzle Problem.
6. Implementation of Monkey Banana Problem.

List of Experiments (Machine Learning)

Python Libraries required: Sklearn

Note: Standard datasets can be downloaded from UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets.php)

1. Implement and demonstrate FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .csv file.
2. For a given set of training data examples stored in a .csv file, implement and demonstrate the candidate elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree classifier. Use appropriate dataset for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to demonstrate the working of Decision tree regressor. Use appropriate dataset for decision tree regressor.
5. Write a program to demonstrate the working of Random Forest classifier. Use appropriate dataset for Random Forest Classifier.
6. Write a program to demonstrate the working of Logistic Regression classifier. Use appropriate dataset for Logistic Regression.

Web Application Development –I			
Subject Code	21CACAS3090	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

List of Experiments

Perform experiments related to the following concepts:

A) HTML

1) Introduction to HTML
2) Browsers and HTML
3) Editor's Offline and Online
4) Tags, Attribute and Elements
5) Doctype Element
6) Comments
7) Headings, Paragraphs, and Formatting Text
8) Lists and Links
9) Images and Tables

B) CSS

1) Introduction CSS
2) Applying CSS to HTML
3) Selectors, Properties and Values
4) CSS Colors and Backgrounds
5) CSS Box Model
6) CSS Margins, Padding, and Borders
7) CSS Text and Font Properties
8) CSS General Topic

INTELLECTUAL PROPERTY RIGHTS			
Subject Code	21CACAN3100	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

Unit -1:	Hours
Introduction: Introduction to Intellectual property, types of intellectual property, importance of intellectual property rights, agencies Responsible for Intellectual property Registration, Regulatory – Compliance and Liability Issues.	08
Unit -2:	
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, Transfer of Rights, protectable matter, selecting and evaluating trade mark, Registrations of Trade Marks, Claims. Trade Secrets: Determination of trade secret status, liability for misappropriations of trade secrets, protection for submission.	10
Unit – 3:	
Copy rights: Fundamental of copy right, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, notice of copy right. Patents: introduction, patent searching process, ownership rights and transfer	10
Unit – 4:	
Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.	10
Unit – 5:	
New development of Intellectual Property: Emerging trends in trade mark; copy rights, patent, International overview on intellectual property.	12

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

IV SEMESTER (II-II)

Semester IV (Second year II-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	BS	21CAMAT4010	Discrete Mathematics	3	0	0	3
2	PC	21CACAT4020	Data Base Management Systems	3	0	0	3
3	PC	21CACAT4030	Design and Analysis of Algorithms	3	0	0	3
4	PC	21CACAT4040	Automata Theory & Compiler Design	3	0	0	3
5	PC	21CACAT4050	Operating Systems	3	0	0	3
6	PC	21CACAL4060	Data Base Management Systems Lab	0	0	3	1.5
7	PC	21CACAL4070	Operating Systems and LINIX Lab	0	0	3	1.5
8	PC	21CACAL4080	Design and Analysis of Algorithms	0	0	3	1.5
9	SOC	21CACAS4090	Web Application Development–II	1	0	2	2
					Total credits		21.5

Category	CREDITS
Basic Science Courses	3
Professional core Courses	16.5
Skill oriented course	2
Internship	
TOTAL CREDITS	21.5

DISCRETE MATHEMATICS			
Subject Code	21CAMAT4010	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 I: Mathematical Logic	Hours
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: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.	10
UNIT II: Set Theory	
Sets Operations on Sets, Principle of Inclusion-Exclusion, Relations Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions.	10
UNIT III: Combinatorics and Number Theory.	
Number Theory: 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: Basics of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations.	10
UNIT IV: Recurrence Relations:	
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.	8
UNIT V: Graph Theory	
Introduction to Graphs, Sub graphs, Graph Representations, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs.	10

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:

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

DATABASE MANAGEMENT SYSTEMS			
Subject Code	21CACAT4020	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 introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- To provide an overview of database transactions and concurrency control.

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

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

DESIGN AND ANALYSIS OF ALGORITHMS			
Subject Code	21CACAT4030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

- The learning objectives of this course are:
- To provide an introduction to algorithms and performance analysis of algorithms.
- To introduce different algorithmic approaches for problem solving through numerous problems

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

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

AUTOMATA THEORY & COMPILER DESIGN			
Subject Code	21CACAT4040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1:Introduction to Formal Languages, DFA, and NFA	Hours
Formal Languages and Regular Expressions: Languages, operations on languages, regular expressions (re),languages associated with (re), operations on (re), Identity rules for (re), Finite Automata: DFA, NFA, Conversion of a regular expression to NFA, NFA to DFA.	10
Unit -2: Context Free Grammars & Introduction to Compilers	
Context Free grammars and parsing: Context free Grammars, Leftmost Derivations, Rightmost Derivations, Parse Trees, Ambiguity Grammars, Phases of compiler, Applications of Finite Automata to lexical analysis.	10
Unit – 3: Parsers	
Top-DownParsing,RecursiveDescentParsers:LL(1)Parsers.BottomupParsers: Shift Reduce Parser, LR Parsers: SLR,CLR,LALR	10
Unit – 4: Intermediate Code Generation & Code Optimization	
Intermediate code generation: Three address code, abstract syntax tree, translation of simple statements and control flow statements. Code Optimization: Issues in the design of code optimization, Principal sources of optimization, optimization of basic blocks, Loop optimization, peephole optimization	10
Unit – 5: Code Generation	
Issues in the design of code Generation, Machine Dependent Code Generation, object code forms, Register allocation and assignment, DAG representation of basic Blocks, Generating code from DAGs	8

Text(T) / Reference(R) Books:	
T1	A Text Book on Automata Theory, Nasir S.F.B, P.K.Srimani, Cambridge university Press
T2	Introduction to Automata Theory,Formal languages and computation, Shamalendu kandar, Pearson
T3	Compilers Principles, echniques and Tools, Aho, Ullman, RaviSethi, PEA
T4	Introduction to theory of computation, 2nd ed, Michelsipser, CENGAGE

T5	Principles of Compiler Design, A.V. Aho. J.D.Ullman;PEA
R1	Theory of Computer Science, Automata languages and computation, 2/e, Mishra, Chandra Shekaran, PHI
R2	Theory of Computation, a problem solving approach, kaviMahesh,Wiley
W1	https://onlinecourses.nptel.ac.in/noc18_cs14/preview

OPERATING SYSTEMS			
Subject Code	21CACAT4050	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Introduce the basic concepts of operating systems, its functions and services.
2. To provide the basic concepts of process management and synchronization.
3. Familiarize with deadlock issues.
4. Understand the various memory management skills.
5. Give exposure over I/O systems and mass storage structures.

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

Text(T) / Reference(R) Books:	
T1	Operating System Concepts Essentials, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons Inc., 2010.
T2	Operating System Concepts, 9th Edition, Abraham Silberschatz, Peter Baer

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

DATABASE MANAGEMENT SYSTEMS LAB			
Subject Code	21CACAL4060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

SQL

Exercise1

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

Exercise2

Queries using operators in SQL

Exercise3

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

Exercise4

Queries using Group By, Order By, and Having Clauses

Exercise5

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

Exercise6

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

Exercise7

Queries on Joins and Correlated Sub-Queries

Exercise 8

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

PL/SQL

Exercise 9

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

Exercise10

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

Exercise11

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

Exercise12

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

Exercise13

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

Exercise14

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

OPERATING SYSTEMS AND LINUX LAB			
Subject Code	21CACAL4070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

UNIX Lab- Introduction to UNIX

1. Study of Unix/Linux general purpose utility commands
2. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.
3. Study of UNIX/LINUX File System(tree structure).
4. C program to emulate the UNIX ls –l command
5. C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls–l | sort
6. Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit () System calls

Operating Systems Lab

1. Simulate the Following CPU Scheduling Algorithms

A) FCFS B) SJF C) Priority D) Round Robin

2. Multiprogramming-Memory Management- Implementation of fork(), wait(), exec() and exit()
3. Simulate The Following

a. Multiprogramming with A Fixed Number Of Tasks (MFT)

b. Multiprogramming with A Variable Number Of Tasks (MVT)

4. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
5. Simulate Bankers Algorithm for Dead Lock Avoidance

DESIGN AND ANALYSIS OF ALGORITHMS LAB			
Subject Code	21CACAL4080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives: This course will enable the students to:

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

LIST OF EXPERIMENTS:

Exercise 1 (Dynamic Programming Technique)

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

Exercise 2 (Dynamic Programming Technique)

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

Exercise 3 (Greedy Methods)

a) Huffman codes
b) Knap Sack Problems

Exercise 4 (Greedy Methods)

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

Exercise 5 (Back Tracking Techniques)

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

Exercise 6 (Back Tracking Techniques)

a) Graph Coloring.
b) Hamiltonian Cycles

Exercise 7 (Back Tracking Techniques)

a) 0/1 Knap Sack Problem

Exercise 8 (Branch and Bound)

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

Exercise 9 (Graph Algorithms)

a) Breadth First Search

b) Depth First Search

Exercise 10 (Graph Algorithms)
a) Kruskal`s Algorithm
b) Prim`s Algorithms

Exercise 11 (Graph Algorithms)
a) Bellman Ford Algorithm
b) Dijkstra`s Algorithm

Exercise 12 (Graph Algorithms)
Floyd- Warshall Algorithm

Web Application Development–II			
Subject Code	21CACAS4090	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Perform experiments related to the following concepts:

1) Introduction to JavaScript

2) Applying JavaScript (internal and external)

3) Understanding JS Syntax

4) Introduction to Document and Window Object

5) Variables and Operators

6) Data Types and Num Type Conversion

7) Math and String Manipulation

8) Objects and Arrays

9) Date and Time

10) Conditional Statements

11) Switch Case

12) Looping in JS

13) Functions

V SEMESTER (III-I)

Semester V (Third year III-I)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CACAT5010	Software Engineering	3	0	0	3
2	PC	21CACAT5020	Data Warehousing and Mining	3	0	0	3
3	PC	21CACAT5030	Computer Networks	3	0	0	3
4	PE	21CACAP504X	Professional Elective -I	3	0	0	3
5	OE	21CAXXO505X	Open Elective - I	3	0	0	3
6	PC	21CACAL5060	Software Engineering Lab	0	0	3	1.5
7	PC	21CACAL5070	Data Mining Lab	0	0	3	1.5
8	SOC	21CMAHS5080	Soft Skills & Aptitude Builder - 1	2	0	0	2
9	PR	21CACAR5090	Summer Internship (Mandatory) after II year (to be evaluated during V Semester)	0	0	0	1.5
10	MC	21CACAN5100	Biology for Engineers	2	0	0	0
					Total credits		21.5

Category	CREDITS
Professional core Courses	12
Open Electives	3
Professonal Electives	3
Skill oriented course	2
Summer Internship	1.5
TOTAL CREDITS	21.5

Professional Elective - I	
Code	Course Title
21CACAP504A	Object Oriented Analysis and

	Design
21CACAP504B	Computer Vision
21CACAP504C	DevOps

SOFTWARE ENGINEERING			
Subject Code	21CACAT5010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

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

DATA WAREHOUSING & MINING			
Subject Code	21CACAT5020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

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

Text(T) / Reference® Books:	
T1	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.

T2	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier
R1	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
R2	Data Mining: Vikram Pudi and P. Radha Krishna, Oxford.
R3	Data Mining and Analysis – Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
R4	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
R5	Data Mining: Introductory and Advanced Topics: Dunham, Pearson.
W1	https://www.edx.org/learn/data-mining
W2	https://www.coursera.org/specializations/data-mining
W3	https://www.coursera.org/courses?query=data%20warehouse

COMPUTER NETWORKS			
Subject Code	21CACAT5030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03

Credits –03

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

Text(T) / Reference(R) Books:	
T1	Computer Networks, 5th Edition, Tanenbaum and David J Wetherall, Pearson Edu, 2010.
T2	Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education.
R1	Computer Networks, Mayank Dave, CENGAGE
R2	Data and Computer Communications, Fifth Edition, William Stallings, PHI, 2005.
R3	Computer Networks, A Systems Approach, Fifth Edition, Peterson & Davie,

	Harcourt, 2011.
R4	Network Management Standards, Second Edition, Ulysses Black, McGraw Hill, 1994
W1	https://swayam.gov.in/courses/5172-computer-networks
W2	https://www.coursera.org/courses?query=computer%20network

Object Oriented Analysis and Design (Professional Elective-I)			
Subject Code	21CACAP504A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

Unit – 1: Introduction	Hours
Introduction to OOAD, Activities/ Workflows / Disciplines in OOAD, Introduction to iterative development and the unified process, Introduction to UML, Mapping Disciplines to UML artifacts, why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.	10
Unit – 2: Classes and Objects	
Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.	10
Unit – 3: Basic Behavioral Modeling	
Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.	10
Unit – 4: Advanced Behavioral Modelling	
Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	10
Unit – 5: Architectural Modelling	
Component, Deployment, Component diagrams and Deployment diagrams. *Case Study:* The Unified Library application.	8

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

COMPUTER VISION (Professional Elective-I)			
Subject Code	21CACAP504B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

Mattes, Video-based Rendering.	

Text(T) / Reference® Books:	
T1	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011.
T2	Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012.
R1	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
R2	Haralick& Shapiro, “Computer and Robot Vision”, Vol II
R3	G_erardMedioni and Sing Bing Kang “Emerging topics in computer vision”166
W1	https://onlinecourses.nptel.ac.in/noc22_ee48/preview

DevOps (Professional Elective-I)			
Subject Code	21CACAP504C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

Unit -1: Introduction	Hours
Phases of Software Development Life Cycle, Values and principles of agile software development.	08
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) / Reference(R) 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.

SOFTWARE ENGINEERING LAB			
Subject Code	21CACAL5060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1

Do the Requirement Analysis and Prepare SRS

Exercise2

Using COCOMO model estimate effort.

Exercise3

Calculate effort using FP oriented estimation model.

Exercise4

Analyze the Risk related to the project and prepare RMMM plan.

Exercise5

DevelopTime-

linechartandprojecttableusingPERTorCPMprojectschedulingmethods.

Exercise6

Draw E-R diagrams, DFD, CFD and structured charts for the project.

Exercise7

Design of Test cases based on requirements and design.

Exercise

8Prepare

FTR

Exercise

9

Prepare Version control and change control for software configuration items.

Exercise10

DesignSoftware

interface

Exercise11

Mini Project

DATA MINING LAB			
Subject Code	21CACAL5070	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

Exercise1

Demonstrate the following data preprocessing tasks using python libraries.

a) Loading the dataset

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

Exercise2

Demonstrate the following data preprocessing tasks using python libraries.

a) Dealing with categorical data

b) Scaling the features

c) Splitting dataset into Training and Testing Sets

Exercise3

Demonstrate the following Similarity and Dissimilarity Measures using python

a) Pearson's Correlation

b) Cosine Similarity

c) Jaccard Similarity

d) Euclidean Distance

e) Manhattan Distance

Exercise4

Build a model using linear regression algorithm on any dataset.

Exercise5

Build a classification model using Decision Tree algorithm on iris dataset

Exercise6

Apply Naïve Bayes Classification algorithm on any dataset

Exercise7

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

Exercise 8

Apply K- Means clustering algorithm on any dataset.

Exercise9

Apply Hierarchical Clustering algorithm on any dataset.

Exercise10

Apply DBSCAN clustering algorithm on any dataset.

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

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	
Unit – 5: Mental Ability	
Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters Number and Letter Analogies: Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy Odd Man Out: Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out Coding and Decoding: Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model Blood relations: Defining the Various Relations among the Members of a Family, Solving Blood Relation Puzzles, Solving the Problems on Blood Relations using Symbols and Notations Direction Sense: Solving Problems by Drawing the Paths, Finding the Net Distance Travelled, Finding the Direction, Problems on Clocks ,Problems on Shadows	7

Section-A: Text (T) / Reference (R) Books:	
For Units 1, 2, & 3	
T1	English and Soft Skills, Dr. S. P. Dhanvel, Orient Blackswan, 2011
R1	Seven Habits of Highly Effective People, Stephen R Covey
R2	Emotional Intelligence, Daniel Goleman, Bantom Book, 2006
R3	21st Century Skills: Learning for Life in our Times, Bernie Trilling, Charles Fadel; John Wiley & Sons
For Units 4&5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A Modern Approach to Logical Reasoning'
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's Verbal Reasoning, LSAT Materials

Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO1	re-engineer attitude and understand its influence on behaviour
CO 2	develop interpersonal skills and be an effective goal oriented team player
CO 3	develop holistic personality with a mature outlook to function effectively in different circumstances
Section B: Aptitude Builder	
CO 4	solve the real-time problems for performing job functions easily
CO 5	analyse the problems logically and critically

BIOLOGY FOR ENGINEERS			
Subject Code	21CACAN5100	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03
Credits – 00			

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

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	
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.	06

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

VI SEMESTER (III-II)

Semester VI (Third year III-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CACAT6010	Artificial Intelligence	3	0	0	3
2	PC	21CACAT6020	Machine Learning	3	0	0	3
3	PC	21CACAT6030	Big Data Analytics	3	0	0	3
4	PE	21CACAP604X	Professional Elective -II	3	0	0	3
5	PE	21CACAP605X	Professional Elective -III	3	0	0	3
6	OE	21CAXXO606X	Open Elective - II	3	0	0	3
7	PC	21CACAL6070	Machine Learning Lab	0	0	3	1.5
8	SOC	21CMAHS6080	Soft Skills & Aptitude Builder - 2	2	0	0	2
9	MC	21CACAN6090	Essence of Indian Traditional Knowledge	2	0	0	0
						Total credits	21.5

Category	CREDITS
Professional core Courses	10.5
Open Electives	3
Professional Electives	6
Skill oriented course	2
Research Internship	
TOTAL CREDITS	21.5

Professional Elective - II	
Code	Course Title
21CACAP604A	Software Project Management
21CACAP604B	Internet of Things

21CACAP604C	Network Programming

Professional Elective - III	
Code	Course Title
21CACAP605A	Software Quality Assurance
21CACAP605B	Distributed Systems
21CACAP605C	Semantic Web

ARTIFICIAL INTELLIGENCE			
Subject Code	21CACAT6010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

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

MACHINE LEARNING			
Subject Code	21CACAT6020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Unit -1:	Hours
Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.	10
Unit -2:	
Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.	10
Unit – 3:	
Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.	10
Unit – 4:	
Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.	10
Unit – 5:	
Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.	8

Text(T) / Reference® Books:	
T1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
T2	Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020
R1	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

BIG DATA ANALYTICS			
Subject Code	21CACAT6030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits– 03			

Course Objectives:
The learning objectives of this course are:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop echo system

Unit -1: Introduction	Hours
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.	08
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.	12
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.	08
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 DataStreams 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.

SOFTWARE PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE - II)			
Subject Code	21CACAP604A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1: Introduction	Hours
Project, Management, Software Project Management activities, Challenges in software projects, stake holders, objectives & goals. Project Planning: Step-wise planning, Project scope, Project products & deliverables, Project activities, Effort estimation, Infrastructure. Project Approach: Life cycle models, choosing technology, prototyping, life cycle phases, process artefacts, process work flows.	10
Unit -2:Effort estimation & Activity Planning	
Estimation techniques, Function point analysis, SLOC, COCOMO, Usecase-based estimation, Activity identification approaches, network planning models, critical path analysis.	10
Unit – 3:Risk management	
Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach.	8
Unit – 4:Project Management and Control	
Creating framework for monitoring and control, progress monitoring, Cost monitoring, Earned value analysis, defects tracking, issues tracking, status reports, Types of resources, Identifying resource requirements, Resource scheduling.	10
Unit – 5:Software Quality	
Planning quality, defining quality – ISO 9016, Quality measures, quantitative quality management planning, product quality & process quality metrics, statistical process control capability maturity model, enhancing software quality.	10

Text(T) / Reference(R) Books:	
T1	Software Project Management, Bob Hughes & Mike Cotterell, TATA McGraw-Hill

T2	Software Project Management, Walker Royce: Pearson Education, 2005
T3	Software Project Management in practice, PankajJalote, Pearson
R1	Software Project Management, Joel Henry, Pearson Education

INTERNET OF THINGS (PROFESSIONAL ELECTIVE - II)			
Subject Code	21CACAP604B	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:
From the course the student will learn

- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

Unit -1:	Hours
The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, Examples OF IoTs, Design Principles For Connected Devices, Internet connectivity, Application Layer Protocols- HTTP, HTTPS, FTP	08
Unit -2 :	
Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and Highlevel 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.	8
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	12

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

Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World	

NETWORK PROGRAMMING (PROFESSIONAL ELECTIVE - II)			
Subject Code	21CACAP604C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- Demonstrate mastery of main protocols comprising the Internet.
- Develop skills in network programming techniques.
- Implement network services that communicate through the Internet.
- Apply the client-server model in networking applications.
- Practice networking commands available through the operating system

Unit -1: Introduction to Network Programming	Hours
Introduction to Network Programming: OSI model, UNIX standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application Elementary Sockets: Sockets introduction, Elementary TCP sockets.	8
Unit -2: TCP client server	
Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.I/O Multiplexing: I/O Models, the select and poll functions, Batch input and buffering, shutdown function.	8
Unit – 3: UDP and Socket options: Elementary UDP sockets	
Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. Socket options: getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function.	10
Unit – 4: Advanced Sockets and Daemon Processes	
IPV4 and IPV6 interoperability, introduction, IPV4 client: IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data.	10
Unit – 5: Broadcasting and Multicasting	
Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multcast socket options. Raw Sockets: Introduction, Raw Socket Creation, Raw Socket Output, Raw	12

Socket Input, Ping Program, Traceroute Program	

Text(T) / Reference(R) Books:	
T1	UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
T2	UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI.
R1	UNIX Systems Programming using C++ T CHAN, PHI.
R2	UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
R3	Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

SOFTWARE QUALITY ASSURANCE (PROFESSIONAL ELECTIVE – III)			
Subject Code	21CACAP605A	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 student should be able to: Demonstration of software quality assurance

- Define the scope of software projects
- .Apply software quality assurance using modern software tools
- .Estimate cost of a project and manage budgets quality assurance and testing project.
- Develop software quality assurance and testing project staffing requirements and effectively manage a project.

Unit -1: FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	Hours
The Role of SQA, SQA Plan, SQA considerations, SQA people, Quality, Management, Software Configuration Management.	10
Unit -2:MANAGING SOFTWARE QUALITY	
Managing Software Organizations, Managing Software Quality, Defect Prevention, Software Quality Assurance Management.	10
Unit – 3:SOFTWARE QUALITY ASSURANCE METRICS	
Software Quality, Total Quality Management (TQM), Quality Metrics, Software Quality Metrics Analysis.	8
Unit – 4:SOFTWARE QUALITY PROGRAM	
Software Quality Program Concepts, Establishment of a Software Quality Program, Software Quality Assurance Planning, An Overview, Purpose & Scope.	10
Unit – 5:SOFTWARE QUALITY ASSURANCE STANDARDIZATION	
Software Standards–ISO 9000 Quality System Standards, Capability Maturity Model and the Role of SQA in Software Development Maturity, SEI CMM Level 5, Comparison of ISO 9000 Model with SEI's CMM.	10

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

DISTRIBUTED SYSTEMS (Professional Elective-III)			
Subject Code	21CACAP605B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems
- To learn distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Unit -1: Distributed Systems	Hours
Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications. Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.	10
Unit -2: Message Ordering & Snapshots	
Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.	10
Unit – 3: Distributed Mutex & Deadlock	
Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport‘s algorithm, Ricart-Agrawala algorithm, Maekawa‘s algorithm, Suzuki–Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp‘s classification, Algorithms for the single resource model, the AND model and the OR model.	10
Unit – 4: Recovery & Consensus	
Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in	10

synchronous systems with failures.	
Unit – 5: Peer-to-peer computing and overlay graphs	
Introduction, Data indexing and overlays, Chord – Content addressable networks, Tapestry. Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion.	8

Text(T) / Reference(R) Books:	
T1	Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
T2	Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.
R1	Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
R2	Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri, McGraw-Hill, 1994.
R3	Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007.

SEMANTIC WEB (Professional Elective-III)			
Subject Code	21CACAP605C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

Unit -1: Web Intelligence	Hours
Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.	10
Unit -2: Knowledge Representation for the Semantic Web	
Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.	08
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® 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.

MACHINE LEARNING LAB			
Subject Code	21CACAL6070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

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

Experiment-1:

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

Experiment-2:

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

Experiment-3:

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

Experiment-4:

Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

Experiment-5:

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

Experiment-6:

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

Experiment-7:

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

Experiment-8:

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

Experiment-9:

Implement the non-parametric Locally Weighted Regression algorithm in order to fit

data points. Select appropriate data set for your experiment and draw graphs

Soft Skills & Aptitude Builder - 2			
Subject Code	21CMAHS6080	IA Marks	15+15
Number of Lecture Hours/Week	2	Exam Marks	35+35
Total Number of Lecture Hours	32	Exam Hours	3
Credits - 2			
Section A, Soft Skills			
Unit – 1: Communicative Competence			Hours
Verbal Reasoning: Reading Comprehension-Text Completion- Sentence Equivalence Spotting Errors, Sequencing of Sentences, Parallelism in Structure E-Mail Etiquette, Reporting News Activity: Completing Exercises			6
Unit 2: Career and Employability Skills			
What is a Career: Career vs Job, Career Values & Grid, Skills vs Strengths, Spotting Skills/Reflection of Present Skills, Meeting the Expectation of your Employer, Matching your Skills with the Required Skills, Preparing Resume, Preparing for Interviews & Structuring Answers Activity: Resume Building, Interviews			6
Section B, Aptitude Builder			
Unit – 3: Time and Work			
Pipes and Cisterns: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours Method, Problems on Alternate Days, Problems on Pipes and Cisterns. Time, Distance and Speed, Problems on Trains, Boats and Streams: Relation between Speed, Distance and Time, Converting km/h into m/s and vice versa , Problems on Average Speed, Problems on Relative Speed, Problems on Circular Tracks, Problems on Races Problems on Trains: Two Trains Moving in Opposite Direction, Two Trains Moving in same Direction, A Train Crossing a Stationary Object of a Given Length like a Platform or Bridge, A Train Crossing a Stationary Object like a Pole or a Man Boats and Streams: Time Based, which can be considered as a Point Object Speed Based, Distance Based, Average Speed Based			6
Unit – 4: Logical and Analytical Reasoning			
Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, ComplexArrangement. 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			7

Conclusions using Syllogism Method Simple Interest: Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal Compound Interest: Definition and Formula for Amount in Compound Interest, Difference between Simple Interest and Compound Interest for 2 Years on the Same Principle and Time Period.	
Unit – 5: Permutations, Probability, Areas and Volumes	
Definition of permutation, Problems on Permutations, Definition of Combinations, problems on Combinations Probability: Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards, Problems on Years Mensuration - 2D:Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas Mensuration - 3D: Problems on Volumes, Problems on Surface Areas	7

Text (T) / Reference (R) Books:	
For Units 1 & 2	
T1	Enhance Your Employability Skills, David Winter and Laura Brammar, University of London
T2	R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003
R2	How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill
For Units 3, 4, & 5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A modern approach to Logical reasoning'
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Materials

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE			
Subject Code	21CACAN6090	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03
Credits – 02			

Course Objectives:

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

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

Text(T) / Reference® Books:	
R1	Traditional Knowledge System in India, by AmitJha, 2009.
R2	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
R3	Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, BharatiyaVidya
R4	Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
R5	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
W1	https://www.youtube.com/watch?v=LZP1StpYEPM
W	https://nptel.ac.in/courses/121106003/

2	
W 3	https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

VII SEMESTER (IV-I)

Semester VII (Fourth year IV-I)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PC	21CAMST7010	Management Science	3	0	0	3
2	HS	21CACAT7020	Deep Learning	3	0	0	3
3	PE	21CACAP703X	Professional Elective -IV	3	0	0	3
4	PE	21CACAP704X	Professional Elective -V	3	0	0	3
5	OE	21CAXXO705X	Open Elective - III	3	0	0	3
6	OE	21CAXXO706X	Open Elective - IV	3	0	0	3
7	SOC	21CACAS7070	Natural Language Processing with Python	1	0	2	2
8	PR	21CACAR7080	Industrial/ Research internship 2 months (Mandatory) after III year (to be evaluated during VII Semester)	0	0	0	3
					Total credits		23

Category	CREDITS
Professional core Courses	3
Open Electives	6
Professional Electives	6
Humanities and social sciences	3
Skill oriented course	2
Research Internship	3
TOTAL CREDITS	23

Professional Elective – IV	
Code	Course Title
21CACAP703A	Software Testing Methodologies
21CACAP703B	Data Visualisation
21CACAP703C	Cloud Computing

Professional Elective – V	
Code	Course Title
21CACAP704A	Blockchain Technologies
21CACAP704B	NOSQL Databases
21CACAP704C	Reinforcement Learning

MANAGEMENT SCIENCE			
Subject Code	21CAMST7010	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 understand the concept of Management its nature importance, Management theories, concept of decision making and organization principles and structures.
To understand the concept of production management in the organization. Workstudy, SQC, inventory management and its techniques.
To understand the concept of HRM and its functions, Marketing Management, Strategic management its components.
To understand the concept of project management PERT, CPM and Project Crashing.
To understand the concepts of recent trends in management

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

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

DEEP LEARNING			
Subject Code	21CACAT7020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

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

SOFTWARE TESTING METHODOLOGIES (PROFESSIONAL ELECTIVE-IV)			
Subject Code	21CACAP703A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1			Hours
Introduction: Purpose of Testing, Dichotomies, Model for Testing, Levels of Testing, Basic definitions, Software Testing Principles, The Tester‘s Roleina Software Development, Consequences of Bugs, Taxonomy of Bugs. Flow graphs and Path testing: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Applications of Path Testing.			10
Unit -2			
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing			08
Unit – 3			
Paths and Regular expressions: Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. Syntax Testing: Grammar for formats, TestCase Generation, Implementation and Application and Testability Tips			10
Unit – 4			
Logic Based Testing: Overview, Decision Tables, KV Charts, and Specifications State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips. Graph Matrices and Application: - Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.			10
Unit – 5			
Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, skills needed for automation, scope of automation, challenges in automation, Introduction to testing tools like Win runner, Load Runner, Selenium and working with selenium			10

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

DATA VISUALIZATION (PROFESSIONAL ELECTIVE-IV)			
Subject Code	21CACAP703B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			
Unit -1: INTRODUCTION TO VISUALIZATION			Hours
Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of VisualizationsAmounts, Distributions, Proportions, x–y relationships, Geospatial Data			10
Unit -2: VISUALIZING DISTRIBUTIONS			
Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots- Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis			08
Unit – 3: VISUALIZING ASSOCIATIONS & TIME SERIES			
Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Tree maps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose– Response Curves, Time Series of Two or More Response Variables			10
Unit – 4: VISUALIZING UNCERTIANITY			
Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, De trending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots			10
Unit – 5: PRINCIPLE OF PROPORTIONAL INK			

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping PointsPartial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Non monotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency	10

Text(T) / Reference(R) Books:	
T1	Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.
T2	OssamaEmbarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018
R1	Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O'Reilly, 2016

CLOUD COMPUTING (PROFESSIONAL ELECTIVE-IV)			
Subject Code	21CACAP703C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

Text(T) / Reference(R) Books:	
T1	Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
T2	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
R1	Cloud Computing, A Hands-on approach, 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

BLOCKCHAIN TECHNOLOGIES (PROFESSIONAL ELECTIVE-V)			
Subject Code	21CACAP704A	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

Text(T) / Reference(R) Books:	
T1	Block Chain: Blueprint for a new economy, Melanie Swan, O'Reilly, 2015.
T2	Block Chain: The Block Chain for Beginners- Guide to Block Chain Technology and Leveraging Block Chain Programming, Josh Thompsons
R1	Block Chain Basics, Daniel Drescher, Apress; 1st edition, 2017
R2	Block Chain and Crypto Currencies, Anshul Kaushik, Khanna Publishing House, Delhi.
R3	Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, Imran Bhashir, Packt Publishing.
W1	https://www.edx.org/learn/blockchain
W2	https://www.coursera.org/courses?query=blockchain

NOSQL DATABASES (PROFESSIONAL ELECTIVE-V)			
Subject Code	21CACAP704B	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.
-

Unit -1:	Hours
Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access	10
Unit -2:	
Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes	10
Unit – 3:	
What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.	10
Unit – 4:	
Document Databases, What Is a Document Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning different Operations, Queries against Varying Aggregate Structure	10
Unit – 5:	

Graph Databases, What Is a Graph Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use	8

Text(T) / Reference(R) Books:	
T1	Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
R1	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
R2	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
R3	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

REINFORCEMENT LEARNING (PROFESSIONAL ELECTIVE-V)			
Subject Code	21CACAP704C	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objective:

- Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

Unit -1:	Hours
Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm	10
Unit -2:	
Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming	10
Unit – 3:	
Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step Q(σ)	10
Unit – 4:	
Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ).	10
Unit – 5:	
Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFORCE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-	08

Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization fr Continuous Actions	

Text(T) / Reference(R) Books:	
T1	R. S. Sutton and A. G. Bart,. “Reinforcement Learning - An Introduction,” MIT Press, 2018
R1	Szepesvári, Csaba, “Algorithms for Reinforcement Learning,” United States: Morgan & Claypool, 2010.
R2	Puterman, Martin L., “Markov Decision Processes: Discrete Stochastic Dynamic Programming,” Germany: Wiley, 2014.

Natural Language Processing with Python			
Subject Code	21CACAS7070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

1. Demonstrate Noise Removal for any textual data and remove regular expression pattern such as hash tag from textual data.
2. Perform lemmatization and stemming using python library nltk.
3. Demonstrate object standardization such as replace social media slangs from a text.
4. Perform part of speech tagging on any textual data.
5. Implement topic modeling using Latent Dirichlet Allocation (LDA) in python.
6. Demonstrate Term Frequency – Inverse Document Frequency (TF – IDF) using python
7. Demonstrate word embeddings using word2vec.
8. Implement Text classification using naïve bayes classifier and text blob library.
9. Apply support vector machine for text classification.
10. Convert text to vectors (using term frequency) and apply cosine similarity to provide closeness among two text.
11. Case study 1: Identify the sentiment of tweets
    In this problem, you are provided with tweet data to predict sentiment on electronic products of netizens.
12. Case study 2: Detect hate speech in tweets.
    The objective of this task is to detect hate speech in tweets. For the sake of simplicity, we say a tweet contains hate speech if it has a racist or sexist sentiment associated with it. So, the task is to classify racist or sexist tweets from other tweets.

Python Libraries: nltk, re,word2vec

Web References:

1. https://www.analyticsvidhya.com/blog/2017/01/ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python/
2. https://datahack.analyticsvidhya.com/contest/linguipedia-codefest-natural-language-processing-1/?utm_source=ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python&utm_medium=blog
3. https://www.analyticsvidhya.com/blog/2018/07/hands-on-sentiment-analysis-dataset-python/

VIII SEMESTER (IV-II)

Semester VIII (Fourth year IV-II)

S.No	Category	Code	Course Title	Hours			Credits
				L	T	P	
1	PR	21CACAR8010	Major Project Work	0	0	24	12
						Total credits	12

Category	CREDITS
Project	12
TOTAL CREDITS	12

SUGGESTED COURSES MINOR ENGINEERING IN CSE-AI&ML

Note:

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

Eligibility for Minor in CSE:

S.No	Subject	L-T-P	Credits	Prescribed Syllabus
1	Introduction to AI&ML	3-0-2	4	4th Semester
2	Data Warehousing and Mining	3-0-2	4	5th semester
3	Machine Learning	3-0-2	4	6th Semester
4	Deep Learning	4-0-0	4	7th semester

Introduction to AI&ML			
Subject Code		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:

4. To provide a strong foundation of fundamental concepts in Artificial Intelligence.
5. To provide a basic exposition to the goals and methods of Artificial Intelligence.
6. To provide fundamentals of machine learning.

Unit -I: Introduction	Hours
What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	10
Unit -II: Problem Solving	
Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.	10
Unit-III: Knowledge Representation	
Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.	10
Unit –IV:	
Introduction to Machine Learning: Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning. Concept Learning and The General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate-Elimination, Inductive Bias	12
Unit-V: Decision Tree Learning	
Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.	8

Text Books/ Reference Books:	
T1	Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Pearson
T2	Tom M. Mitchell, *Machine Learning,* McGraw Hill Edition, 2013
R1	Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011
R2	Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill

R3	Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.
R4	ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

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

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

Text(T) / Reference® Books:	
T1	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.

T2	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier
R1	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
R2	Data Mining: Vikram Pudi and P. Radha Krishna, Oxford.
R3	Data Mining and Analysis – Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
R4	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
R5	Data Mining: Introductory and Advanced Topics: Dunham, Pearson.
W1	https://www.edx.org/learn/data-mining
W2	https://www.coursera.org/specializations/data-mining
W3	https://www.coursera.org/courses?query=data%20warehouse

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

Course Objectives:

The learning objectives of this course are:

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Unit -1:	Hours
Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.	10
Unit -2:	
Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.	10
Unit – 3:	
Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.	10
Unit – 4:	
Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.	10
Unit – 5:	
Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.	8

Text(T) / Reference® Books:	
T1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
T2	Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020
R1	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

DEEP LEARNING			
Subject Code	21CACAT7020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

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

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

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

Suggested Courses for Honors Program

POOL1- AI & ML	POOL2- Systems Engineering
1. Mathematics for Machine Learning 2. Text Mining and Time Series Analysis 3. Natural Language Processing 4. Reinforcement Learning	1. Internet of Things 2. Data Communications and Information Coding Theory 3. Service Oriented Architectures 4. Design of Secure Protocols 5. Network Coding
POOL3- Information Security	**POOL4 – Data Science**
1. Principles of Cyber Security 2. Computational Number Theory 3. Public Key Infrastructure and Trust Management 4. Information Security Analysis and Audit 5. Cloud and IoT Security 6. Web Security 7. Block Chain Architecture Design and Use Cases	1. Data Visualization 2. Statistical Foundations for Data Science 3. Mining Massive Data Sets 4. Medical Image Data Processing

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

Course Objectives:

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

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

Text(T) / Reference(R) Books:

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

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

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

Course Objectives:

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

Unit -1:	Hours
Introduction to Text Mining: Introduction, Algorithms for Text Mining, Information Extraction from Text: Introduction, Named Entity Recognition, Relation Extraction, Unsupervised Information Extraction. Text Summarization Techniques: Extractive Summarization, Topic Representation Approaches, Influence of Context, Indicator Representation and Machine Learning for Summarization.	08
Unit -2:	
Text Clustering Algorithms: Introduction, Feature Selection and Transformation Methods for Text Clustering, Distance-Based Clustering Algorithms, Word and Phrase-based Clustering, Probabilistic Document Clustering and Topic Modelling. Dimensionality Reduction and Topic Modelling: Latent Semantic Indexing, Topic Models and Dimension Reduction.	10
Unit – 3:	
Text Classification Algorithms: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-based Classifier, Probabilistic and Naïve Bayes Classifiers, Linear Classifier, Proximity- based Classifier, Meta-Algorithms for Text Classification, Probabilistic Models for Text Mining: Mixture models, Stochastic Processes in Bayesian Nonparametric Models, Graphical Models.	10
Unit – 4:	
Characteristics of Time Series: Introduction, Nature of Time Series Data, Time Series Statistical Models, Measures of Dependence: Autocorrelation and Cross-Correlation, Stationary Time Series, Time Series Regression and	10

Exploratory Data Analysis: Classical Regression, Exploratory Data Analysis, Smoothing.	
Unit – 5:	
ARIMA Models: Introduction, Autoregressive Moving Average Models, Difference Equations, Autocorrelation and Partial Autocorrelation, Building ARIMA Models, Multiplicative Seasonal ARIMA Models, Spectral Analysis and Filtering: Cyclical Behaviour and Periodicity, Spectral Density, Periodogram and Discrete Fourier Transform, Nonparametric and Parametric Spectral Estimation, Linear Filters, Dynamic Fourier Analysis and Wavelets.	12

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

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

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

Course Objectives:

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

Unit -1:	Hours
Introduction :Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.	08
Unit -2:	
Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Back off– Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation - based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.	10
Unit – 3:	
Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures	10
Unit – 4:	
Semantics And Pragmatics: Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary &	10

Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.	
Unit – 5:	
Discourse Analysis And Lexical Resources : Discourse segmentation, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus(BNC).	12

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

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

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

Course Objectives:

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

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

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

Eligibility Traces using Important Sampling, Variable λ.	
Unit – 5:	
Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting and Learning, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.	12

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

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

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

Course Objectives:

The main objectives of this course are

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

Unit -1:	Hours
The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP,Telnet.	08
Unit -2:	
Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability	10
Unit – 3:	
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.	10
Unit – 4:	
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.	10
Unit – 5:	
Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a	12

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	

Text(T) / Reference(R) Books:	
T1	Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill HigherEducation
T2	Internet of Things, A.Bahgya and V.Madisetti, UnivesityPress,2015
R1	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley
R2	Getting Started with the Internet of Things, CunoPfister ,Oreilly

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

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

Course Objective:

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

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

Text(T) / Reference(R) Books:

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

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

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

Course Objectives:

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

Unit -1:	Hours
Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles Architecting Process for Software Applications: Architectural Considerations, Architecting Process for Software Applications, Level 0: High-Level Architecture, Level 1: Solution Architecture Detailed Design	08
Unit -2:	
SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA Service-oriented Architecture and Microservices architecture –Drivers for SOA, Dimensions of SOA, Conceptual Modelof SOA, Standards And Guidelines for SOA, Emergence of MSA Service-Oriented Architecture: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process,Service-oriented Analysis and Design (SOAD) Process	10
Unit – 3:	
Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model Service-Oriented Analysis and Design: Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process	10

Services	
Unit – 4:	
Microservices Architecture: Trend in SOA – Microservices Architecture (MSA): Services Model for Cloud and Mobile Solutions, API Adoption on the Rise, Challenges and Takeways from SOA Implementations Architecture Trend – Microservices Architecture, Microservices Architecture in Action Cloud and MSA:Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions	10
Unit – 5:	
Mobile and MSA: Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIary PoC	12

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

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

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

Course Objectives:

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

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

Text(T) / Reference(R) Books:	
T1	Jawin: “Networks Protocols Handbook”, 3rd Edition, Jawin Technologies Inc.,2005.
T2	Bruce Potter and Bob Fleck : “802.11 Security”, 1st Edition, O’Reilly

	Publications,2002.
R1	Ralph Oppliger :"SSL and TSL: Theory and Practice", 1st Edition, Arttech House,2009.
R2	Lawrence Harte: "Introduction to CDMA- Network services Technologies and Operations", 1st Edition, Althos Publishing,2004.
R3	Lawrence Harte: "Introduction to WIMAX", 1st Edition, Althos Publishing,2005

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

NETWORK CODING (Systems Engineering)			
Subject Code		IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits –			

Course Objectives:

- Students will gain the understanding of core network programming by using sockets and transport layer protocols like TCP and UDP
- Students will gain the understanding of inter process communication and implementation of different forms of IPC in client-server environment
- Students will get an exposure to various application layer protocols which are designed using sockets and transport layer protocols

Unit -1:	Hours
Introduction to Network Programming: OSI model, transport layer protocols: TCP, UDP and SCTP, network architecture: client-server and peer-to-peer systems, Sockets-socket Address structures: IPv4, IPv6 and Generic-value result arguments, Byte ordering functions, Byte manipulation functions, Address conversion functions	08
Unit -2:	
TCP: introduction to TCP, TCP connection establishment and termination TIME_WAIT State. Elementary TCP sockets, Socket, connect, bind, listen, accept, fork, exec function, concurrent servers, Close function, read and write functions	10
Unit – 3:	
TCP echo client server program, getsockname and getpeername functions I/O multiplexing: I/O models, Select function, TCP echo server using select function, shutdown function, Poll function	10
Unit – 4:	
UDP: Introduction to UDP, difference between TCP and UDP, recvfrom( ) and sendto( ) functions, UDP echo client server program, UDP echo client server using select function. Socket Options: IPv4 socket options, IPv6 socket options	10
Unit – 5:	
Socket Options: Generic socket options, TCP socket options. IPC: Introduction to IPC, forms of IPC, UNIX kernel support for pipes, FIFO, message queues, semaphores and shared memory Network programming concepts Implementation: FTP, ping, arp,	12

SMTP, TELNET	

Text(T) / Reference(R) Books:	
T1	Unix Network programming, the socket networking API, W.Richard Stevens, bill fenner, Andrew m.rudoff ,PHI.
R1	Advanced programming in the UNIX environment, W.Richard Stevens, pearson education

Course Outcomes:	
CO1	Explain the client-server paradigm and socketstructures.
CO2	Describe the basic concepts of TCP sockets and TCP echo client-serverprograms.
CO3	Discuss the UDP sockets and UDP echo client-serverprograms.
CO4	Explain Socket options and ability to understandIPC
CO5	Apply the applications of sockets and demonstrate skill to design simple applications like FTP, TELNETetc

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

Credits – 4

Course Objectives:

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

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

Text(T) / Reference(R) Books:	
T1	NASSCOM: Security Analyst Student Hand Book, Dec2015
T2	Information Security Management Principles, Updated Edition, David Alexander, AmandaFinch,David Sutton, BCS publishers, June2013

R1	Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security,2nd Edition, ISACA Publishers, 2019

Course Outcomes:	
CO1	Apply cyber security architecture principles.
CO2	Demonstrate the risk management processes and practices.
CO3	Appraise cyber security incidents to apply appropriate response
CO4	Distinguish system and application security threats and vulnerabilities.
CO5	Identify security tools and hardening techniques

COMPUTATIONAL NUMBER THEORY (Information Security)			
Subject Code		IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

This course will focus on designing efficient algorithms (and providing complexity analysis) for the most important problems from number theory, with major applications in coding theory and cryptography.

Unit -1:	Hours
Introduction to Network Programming: OSI model, transport layer protocols: TCP, UDP and SCTP, network architecture: client-server and peer-to-peer systems, Sockets-socket Address structures: IPv4, IPv6 and Generic-value result arguments, Byte ordering functions, Byte manipulation functions, Address conversion functions	08
Unit -2:	
TCP: introduction to TCP, TCP connection establishment and termination TIME_WAIT State. Elementary TCP sockets, Socket, connect, bind, listen, accept, fork, exec function, concurrent servers, Close function, read and write functions	10
Unit – 3:	
TCP echo client server program, getsockname and getpeername functions I/O multiplexing: I/O models, Select function, TCP echo server using select function, shutdown function, Poll function	10
Unit – 4:	
UDP: Introduction to UDP, difference between TCP and UDP, recvfrom( ) and sendto( ) functions, UDP echo client server program, UDP echo client server using select function. Socket Options: IPv4 socket options, IPv6 socket options	10
Unit – 5:	
Socket Options: Generic socket options, TCP socket options. IPC: Introduction to IPC, forms of IPC, UNIX kernel support for pipes, FIFO, message queues, semaphores and shared memory Network programming concepts Implementation: FTP, ping, arp, SMTP, TELNET	12

Text(T) / Reference(R) Books:	
T1	Unix Network programming, the socket networking API, W.Richard Stevens, bill fenner, Andrew m.rudoff ,PHI.

R1	Advanced programming in the UNIX environment, W.Richard Stevens, pearson education

Course Outcomes:	
CO1	Explain the client-server paradigm and socketstructures.
CO2	Describe the basic concepts of TCP sockets and TCP echo client-serverprograms.
CO3	Discuss the UDP sockets and UDP echo client-serverprograms.
CO4	Explain Socket options and ability to understandIPC
CO5	Apply the applications of sockets and demonstrate skill to design simple applications like FTP, TELNETetc

PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT (Information Security)			
Subject Code		IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course objectives:

The course is designed to train the graduates in depth understanding of Public Key Cryptography, Public key Infrastructure, security credentials and design new or modify existing cryptographic techniques.

Unit -1:	Hours
Public key infrastructure: components and architecture. PKI interoperability, deployment and assessment PKI data structures – certificates, validation, revocation, authentication, cross-certification. Repository, Certification Authority (CA) and Registration Authority (RA), trusted third party, digital certificates.	08
Unit -2:	
PKI Services: Authentication, Integrity and Confidentiality, Mechanisms, Secure Communication, Secure Time Stamping, Non-Repudiation, Privilege Management, Certificate policies, Certificate Authority, Registration Authority.	10
Unit – 3:	
Key and Certificate Management: Key/Certificate Life Cycle Management, Certificate Revocation: Periodic Public Mechanisms, performance, Scalability and Timeliness, Multiple Key pairs, Key Pair Uses, Real-World Difficulties, Independent Certificate Management.	10
Unit – 4:	
Trust Models: Strict Hierarchy of Certification Authorities, Distributed Trust Architecture, Web Model, User-Centric Trust, Cross-Certification, Entity Naming, Certificate Path processing, PKI Information Dissemination: Repositories and Techniques, private Dissemination, Public and Repositories, In-Band Protocol Exchange.	10
Unit – 5:	
PKI Standards: Introduction, Major Standards Activities, X.509, PKIX, X.500, LDAP, ISO TC68, ANSI X9f, S/MIME, IPsec, TLS, SPKI, OpenPGP, EDIFACT.	12

Text(T) / Reference(R) Books:

T1	Carlisle Adams, Steve Lloyd, Understanding Public-Key Infrastructure: Concepts, Standards, and Deployment Considerations, Sams,1999.
T2	John R. Vacca, Public Key Infrastructure, Building Trusted Applications and Web Services, Auerbach Publications,2004.
R1	Messaoud Benantar, Introduction to the Public Key Infrastructure for the Internet, Pearson Education, Prentice Hall,2011.
R2	Ashutosh Saxena, Public Key Infrastructure, Tata McGrawHill.

Course Outcomes:	
CO1	pth understanding of Public key cryptography andInfrastructure.
CO2	y to design and analyze Public Key cryptographictechniques.
CO3	y to solve network security issues in real timeapplications.
CO4	y to take up doctoral level research work insecurity.

INFORMATION SECURITY ANALYSIS AND AUDIT (Information Security)			
Subject Code		IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	3:00 Hrs
Credits – 4			

Course Objectives:

- Understanding and knowledge of Security Auditing, and introduce the Threats and defense in the systems.
- Acquiring the knowledge on Evidence collection and evaluation techniques.

Unit -1:	Hours
Overview of Information System Auditing- Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit.	08
Unit -2:	
The management Control Framework-I- Introduction, Evaluating the planning Function, Leading Function, Controlling Function, Systems Development Management Controls, Approaches to Auditing Systems Development, Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls.	10
Unit – 3:	
The Management Control Framework-II- Security Management Controls, Operations management Controls Quality assurance Management Controls, Case Studies.	10
Unit – 4:	
Evidence Collection- Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools- Case Studies.	10
Unit – 5:	
Evidence Evaluation- Evaluating Asset Safeguarding and Data Integrity, Evaluating System, Effectiveness, Evaluating System Efficiency, Information Systems Audit and Management: Managing the Information Systems Audit Function.	12

Text(T) / Reference(R) Books:

T1	Information Systems Control and Audit, 1st Edition, Ron Weber, Pearson Education,2013.
R1	Information System Audit and Assurance, D P Dube, TMH, New Delhi,2008

Course Outcomes:	
CO1	Illustrate the fundamental concepts of information security and system sauditing
CO2	Analyze the latest trend of computer security threats and defense
CO3	Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms
CO4	Explain the security controls in the aspects of physical, logical and operational security control and case studies
CO5	Evaluate the security of information systems

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

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

Text(T) / Reference(R) Books:	
T1	Practical Internet of Things Security (Kindle Edition) by Bria Russell, Drew

	Van Duren
R1	Securing the Internet of Things, Elsevier
R2	Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations

Course Outcomes:	
CO1	ss about Security Requirements in IoT Architecture
CO2	in Random number generation
CO3	nstrate Authorization with Publish / Subscribe schemes
CO4	fy Lightweight and robust schemes for Privacy protection
CO5	in about IoT cloud security architecture

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

Course Objectives:

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

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

Text(T) / Reference(R) Books:

T1	Web Hacking: Attacks and Defense, Latest Edition , McClure, Stuart, Saumil Shah, and Shreeraj Shah, Addison Wesley,2003
T2	Professional Java Security, 1.3 Edition, Garms, Jess and Daniel Somerfield, Wrox,2001

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

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

Course Objectives:

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

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

Unit -1:	Hours
Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. Evolution of Blockchain : Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.	08
Unit -2:	
Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.	10
Unit – 3:	
Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.	10
Unit – 4:	
Ethereum Blockchain Implementation: Introduction, Tuna Fish	10

Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts.	
Unit – 5:	
Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application. Advanced Concepts in Blockchain: Introduction, InterPlanetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.	12

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

Course Outcomes:	
CO1	Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
CO2	Identify the risks involved in building Block chain applications.
CO3	Review of legal implications using smart contracts.
CO4	Choose the present landscape of Blockchain implementations and Understand Crypto currency markets
CO5	Examine how to profit from trading cryptocurrencies.

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

Course Objectives:

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

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

Text(T) / Reference(R) Books:	
T1	Interactive Data Visualization: Foundations, Techniques, and Applications Ward, Grinstein, Keim,
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:	
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

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

Course Objectives:

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

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

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

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

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

Course Objectives:

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

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

Text(T) / Reference(R) Books:	
T1	Jure Leskovec, Anand Rajaraman, Jeffery D. ULLman, Mining of Massive Datasets, Cambridge University Press, 2014.
T2	Pattern Recognition and Machine Learning. Christopher Bishop. Springer-Verlag New York.2006.
R1	Machine Learning: A Probabilistic Perspective. Kevin Murphy. MIT

	Press.2012
R2	The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer.2013

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

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

Course Objectives:

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

Unit -1:	Hours
Introduction: Introduction to Medical Imaging Technology, Systems, and Modalities. Brief History, Importance, Applications, Trends, Challenges. Medical Image Formation Principles: X-Ray physics, X- Ray generation, Attenuation, Scattering, Dose Basic Principles of CT, Reconstruction Methods, Artifacts, CThardware.	08
Unit -2:	
Storage and Processing: Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS); Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics; filtering; histogram modeling.	10
Unit – 3:	
Visualization: Medical Image Visualization Fundamentals of Visualization, Surface and Volume Rendering/Visualization, Animation, Interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, Spin Physics, NMR Spectroscopy, Imaging Principles and Hardware, Image Artifacts.	10
Unit – 4:	
Segmentation And Classification: Medical Image Segmentation, Histogram-Based Methods, Region Growing and Watersheds, Markov Random Field Models, Active Contours, Model-Based Segmentation. Multi-Scale Segmentation, Semi-Automated Methods, Clustering-Based Methods, Classification-Based Methods, Atlas-Guided Approaches, Multi-Model Segmentation. Medical Image	10

Registration Intensity- Based Methods, Cost Functions, Optimization Techniques.	
Unit – 5:	
Nuclear Imaging: PET and SPECT Ultrasound Imaging Methods, Mathematical Principles, Resolution, Noise Effect, 3D Imaging, Positron Emission Tomography, Single Photon Emission Tomography, Ultrasound Imaging, Applications. Medical Image Search and Retrieval Current Technology in Medical Image Search, Content-Based Image Retrieval, New Trends: Ontologies, Applications, Other Applications Of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic SupportSystems.	12

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

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