PRASAD V POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(Autonomous)

ACADEMIC RULES & REGULATIONS (PVP19)

and

FOUR YEAR B.Tech Course Structure

Applicable for the batch of students admitted from the Academic Year 2019-2020

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(Autonomous)

AICTE approved, NBA & NAAC Accredited, An ISO 9001:2015 certified Institution

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PREFACE

PVP Siddhartha Institute of technology, established in 1998, is one of the seventeen educational institutions sponsored and run by Siddhartha Academy of General & Technical Education. The 250 members of the Academy are a group of industrialists, educationists, auditors and philanthropists with vast experience in their respective fields and above all with an ardent desire to spread quality Education. All the academic organizations of Siddhartha Academy stand symbolic of the pragmatic vision of its founders. PVP Siddhartha Institute of Technology has the advantage of inheriting the higher academic standards. The college is approved by AICTE and is permanently affiliated to JNTUK. It is certified by ISO 9001-2015 for its quality standard. It is accredited by the National Board of Accreditation and NAAC with A^+ grade. Moreover, it is an Autonomous College.

The curriculum is revised continuously to address the challenges of industry and academia and to foster the global competencies among the students. The curriculum is revised two times since 2012. The present curriculum(PVP19) is designed incorporating the features such as outcome based approach, Choice Based Credit System, encouraging self-learning through MOOCs platforms i.e., Swayam, Courses Era, EDX, NPTEL, etc., Transformation of creative ideas into a prototype through project phase I & phase II, enhancing depth & breadth by introducing more number of programs, open & interdisciplinary electives in core and multi-disciplinary areas, offering courses by industry experts to improve Industry Institute Interaction in addition to internships at industry and introduction of wide range of value added courses beyond curriculum to choose according to their interest to enhance their skills and employability.

Prasad V. Potluri Siddhartha Institute of Technology

Department of Computer Science and Engineering

Vision

To be a centre of excellence in academics and research in Computer Science and Engineering and take up challenges for the benefit of society.

Mission

- Impart professional education through best curriculum in harmony with the industry needs.
- Inculcate ethics, research capabilities and team work in the young minds so as to put efforts to the advancement of the nation.
- Strive for student achievement and success with leadership qualities and preparing them for continuous learning in the global environment.

Program Educational Objectives (PEOs)

- PEO-I: The graduates of the program will excel in the concepts of basic engineering and advanced concepts of computer science engineering.
- PEO-II: The graduates of the program will be professional in computing industry or pursuing higher studies.
- PEO-III: The graduates of the program will excel in team work, ethics, communication skills and contribute to the benefit to the society.

Program Outcomes (POs)

PO-1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-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.

PO-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.

PO-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.

PO-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.

PO-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.

PO-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.

PO-8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-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.

PO-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.

PO-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.

Program Specific Outcomes (PSOs)

PSO-I: Apply the Knowledge of Computing Skills in building the Software Systems that meet the requirements of Industry and Society.

PSO-II: Apply the Knowledge of Data Engineering and Communication Technologies for Developing Applications in the Domain of Smart and Intelligent Computing.

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1. SHORT TITLE ANDCOMMENCEMENT

a. The regulations listed under this head are common for all degree level undergraduate programmes (B.Tech.), offered by the college with effect from the academic year 2019-20 and they are called as "PVP19" regulations.

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

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 Prasad V Potluri Siddhartha Institute of Technology, Vijayawada;

e. An **Academic Programme** means any combination of courses and/or requirements leading to award of a degree.

f. "**Course**" means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g. "**Degree**" means an academic degree conferred by the university upon those who complete the undergraduate curriculum.

h. "**CBCS**" means Choice Based Credit System

i. "**MOOC**" means Massive Open Online Course

j. "**Regular Students**" means students enrolled into the four year programme in the first year.

k. "**Lateral Entry Students**" means students enrolled into the four year programme in the second year.

3. ACADEMICPROGRAMMES

3.1 Nomenclature of Programmes

3.1.1 The nomenclature and its abbreviation given below, shall continue to be used for the Degree programmes under the University, as required by the Council and the Commission:

Bachelor of Technology (B. Tech)

Besides, the name of specialization shall be indicated in brackets after the abbreviation, for example, engineering degree in Mechanical Engineering programme is abbreviated as B.Tech (Mechanical Engineering).

3.1.2 Bachelor of Technology (B. Tech.) degree programme is offered in:

1. Civil Engineering(CE)
2. Computer Science and Engineering(CSE)
3. Electronics and Communication Engineering(ECE)
4. Electrical and Electronics Engineering(EEE)
5. Information Technology(IT)
6. Mechanical Engineering(ME)

4. DURATION OF THE PROGRAMMES

4.1 Normal Duration

4.1.1. The duration of an academic programme shall be four years consisting of eight semesters.

4.1.2. The duration of the programme for lateral entry students who are admitted in II year shall be three years that consists of six semesters.

4.2 Maximum Duration

4.2.1 The maximum period for which a student can take to complete a full time academic programme shall be double the normal duration of the programme, i.e., for regular students eight years, for lateral entry students six years.

4.3 Minimum Duration of a Semester

Each semester consists of a minimum of 90 instruction days excluding examination days with about minimum 26 and maximum 35 contact hours per week.

5. ADMISSION CRITERIA

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time.

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at I year level and only CATEGORY-A at Lateral Entry II year level.

The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

5.1 CATEGORY – A Seats

Category - A seats are filled as per the norms approved by the Government of Andhra Pradesh.

5.2 CATEGORY – B Seats

Category - B seats are filled by the College as per the norms approved by the Government of Andhra Pradesh.

5.3 CATEGORY - Lateral Entry Seats

Lateral entry candidates shall be admitted into the III semester directly as per the norms approved by Government of Andhra Pradesh.

6. CREDIT SYSTEM AND GRADEPOINTS

6.1 Credit Definition

'Credit' means quantified and recognized learning. Credit is measured in terms of contact hours per week in a semester. Typically one credit is given to:

(a) Theory/Tutorial course conducted for one contact period.

(b) Laboratory course conducted for two contact periods.

Each course is assigned a certain number of credits depending upon the number of contact hours (Lectures/Tutorials/Practical) per week.

The curriculum of the eight semesters B.Tech program is designed to have a total of 160 credits for the award of B.Tech degree.

For lateral entry students, the curriculum of six semesters B.Tech program is designed to have a total of 121.5 credits for the award of B.Tech degree.

6.2 Semester Course Load

The average course load shall be fixed at 20 credits per semester with its minimum and maximum limits being set at 13 and 24.5 credits.

6.3 Grade Points and Letter Grade for a Course

The grade points and letter grade will be awarded to each course based on student's performance as per the grading system shown in the Table1.

Table 1: Grading System for B. Tech Programme

Theory/Drawing % of Marks	Laboratory/Project % of Marks	Grade Points	Letter Grade
≥90%	≥90%	10	S
80 – 89%	80 – 89%	9	A
70 - 79%	70 - 79%	8	B
60 - 69%	60 - 69%	7	C
50 - 59%	55 - 59%	6	D
40 - 49%	50 – 54%	5	E
< 40%	< 50%	0	F (FAIL)
ABSENT	ABSENT	0	AB

6.4 Semester Grade Points Average(SGPA)

The performance of each student at the end of the each semester is indicated in terms of SGPA calculated as shown in equation (1).

$$SGPA = \frac{\sum(CR \times GP)}{\sum CR \ (\text{for all courses offered in the semester})} \quad \text{-- (1)}$$

Where CR= Credits of a course

GP = Grade points awarded for a course

6.5 Cumulative Grade Point Average (CGPA)

The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA which is calculated as shown in equation (2).

$$CGPA = \frac{\sum CR\ X\ GP}{\sum CR(for\ all\ courses\ offered\ upto\ that\ semester/entire\ program)} \quad \text{-- (2)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

Percentage equivalent of CGPA = (CGPA – 0.5) * 10

7. CURRICULUM FRAMEWORK

7.1 General Issues

7.1.1 Curriculum framework is important in setting the right direction for a degree programme as it takes into account the type and quantum of knowledge necessary to be acquired by a student in order to qualify for the award of degree in his/her chosen branch or specialization.

7.1.2 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 in fulfilling the requirements for conferment of degree.

7.1.3 Each theory course shall consist of five units.

7.2 Curriculum Structure

The curriculum is designed to facilitate CBCS and incorporates courses required to attain the expected knowledge, skills and attitude by the time of graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 7.2.1 to7.2.6) to cover the depth and breadth required for the programme and for the attainment of programme outcomes of the corresponding programme.

7.2.1 Institutional Core

Institutional Core consists of the courses required for all UG Engineering Programmes offered in this college. The courses offered under this category cover the required knowledge in the following areas:

(a) Basic Sciences:

Basic Science courses include Engineering Physics, Applied Physics, Engineering Physics Lab, Applied Physics Lab Engineering Chemistry, Chemistry of Materials, Engineering Chemistry Lab,

Chemistry of Materials Lab, Mathematics I (calculus and Algebra), Engineering Mathematics II (ODE, PDE and Multivariable Calculus), Engineering Mathematics III, Engineering Mathematics IV, Life Sciences for Engineers and Life Sciences for Engineers Lab.

(b) Engineering Sciences:

Engineering Science courses include Problem Solving and Programming, AI Tools, Internet of Things, Design Thinking & Product Innovation, Basic Electrical and Electronics Engineering, Engineering Graphics, Problem Solving & Programming Lab, Basic Electrical & Electronics Engineering Lab, AI Tools Lab, Internet of Things Lab, Design Thinking and Product Innovation Lab and Basic Workshop.

(c) Humanities and Social Sciences:

Humanities and Social Science Courses consist of Communicative English I, Communicative English II, HS-I (Engineering Economics & Management), HS-II (Organizational Behavior), Communicative English I Lab and Communicative English II Lab.

7.2.2 Elective Courses

Elective courses are offered across the programmes to enhance the knowledge breadth and professional competency of the students.

Courses	Branch Specific	Compulsory
Elective courses	Program Electives	Supportive to the discipline courses with expanded scope in a chosen track of specialization or cross track courses
	Interdisciplinary Electives	Interdisciplinary exposure & nurture the student interests in other department courses
	Open Electives	Common to all disciplines that helps general interest of a student

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (MOOCs) during the period of study. Students without any backlog courses upto III semester are permitted to register for MOOCs from IV semester onwards upto a maximum of 15 credits from Program Elective/Interdisciplinary Elective/Open Elective Courses. However, the Departmental Committee (DC) has to approve the courses under MOOCs. The Departmental committee consists of Head of the Department, Program coordinator and Module Coordinator.

Students can register and complete the opted course in approved MOOCs platform on or before the last instruction day of IV/V/VI/VII semester. They have to submit the pass certificate before the last instruction day of that concerned semester.

7.2.3 Programme Core

The Programme core consists of set of courses considered which are necessary for the students of the specific programme. The courses under this category satisfy the Programme Specific Criteria prescribed by the appropriate professional societies.

7.2.4 Project

Project Phase I & Project Phase II will be initiated in VII semester and completed before the end of VIII semester.

Project Phase I can be done by a group of students, working under the guidance of a faculty member and carrying out a detailed feasibility study, literature survey and submit a report regarding work plan for the project phase II.

Project Phase II involves continuation of Project Phase I. The objective is to complete the work as per the prepared work plan and submit a detailed project report.

7.2.5 Industry Interaction

The students may register for either Internship or Industry offered course during the summer break after VI semester to secure 2 credits.

Internship/Industry offered courses are purely meant for internal Assessment which will be evaluated for 75 marks during the VII semester.

a) Internships

The students may undergo Internship for 3 to 6 weeks duration in the industry approved by respective head of the department at the end of VI semester.

b) Industry offered courses

The students can opt for the courses under this category that are offered by the Industry experts whose minimum academic qualification is Bachelor of Engineering or equivalent.

7.2.6 Mandatory Learning Courses

According to the guidelines given by statutory bodies, Courses on Environmental Science, Constitution of India and Engineering Ethics shall be offered.

Induction program shall be offered in I semester for all the branches.

NCC/NSS/NSO/YOGA shall be offered in I & II semesters.

Environmental Science and Constitution of India shall be offered in III & IV semesters.

Engineering Ethics shall be offered in V/VI semesters.

7.3 Course Numbering Scheme

The Course code consists of Eight/Nine characters. The following is the structure of the course Code (Figure 1).

1 9	C S	1	2	0	3	A
Regulation	**Course Category**	**Kind of course**	**Semester**	**Type**	**Course Number**	**[Elective code]**
Last two digits of Regulation offered (i.e. 19 for PVP19 regulations)	HS - Humanities and Social Sciences including Management courses BS - Basic Science courses ES - Engineering Science MC - Mandatory Courses In case of Professional Core/ Professional Elective courses department code is placed: CE - Civil Engineering CS - Computer Science & Engineering EC - Electronics and Communication Engineering EE - Electrical & Electronics Engineering IT - Information Technology ME - Mechanical Engineering	1. Institutional Core (i.e. HS, BS, ES, MC) 2. Inter Disciplinary Elective 3. Program Core 4. Program Elective 5. Open Elective	1- First 2- Second 3- Third 4- Fourth 5- Fifth 6- Sixth 7- Seventh 8- Eight	0- Theory 1-Theory studied in MOOCS Mode 5- Practical 6- Project Work 7- Industrial Training/ Internship	i.e. Course sequence Number in that semester	Incase if the course is Elective then this field will specify the elective code (i.e. A, B, C.)

Figure 1: Course numbering scheme

7.4 Medium of Instruction and Examination

The medium of instruction and examinations shall be English.

7.5 Registration

Every student has to register himself/herself for the courses in each semester individually at the time as specified in academic calendar.

8. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) shall be introduced with effect from 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- Activity based learning
- Student centered learning
- Students to choose courses of their choice
- Learning at their own pace
- Interdisciplinary learning

Flexibility is extended to the fast learning students to take the courses of higher semesters in advance as per their convenience to concentrate on their placement activity/ project work, etc., during the VII/VIII semesters.

8.1 CBCS Course Registration Policy

Fast learning students can register for additional courses from higher semesters by satisfying the pre-requisite course(s) to a maximum of 8 credits in each of the semesters from III semester onwards along with the regular semester courses as prescribed. There is no minimum limit to the credits for taking additional courses.

Eligibility for choosing CBCS flexibility:

- **Regular Students (4 Year duration),** entering the n^{th} semester with no backlog courses up to $(n-1)^{th}$ semester, are only eligible to opt for this flexibility.
- **Lateral entry students (3 year duration)** with 70% Marks in their Diploma are eligible to opt for this flexibility during III and IV Semesters. Those students entering into V/ VI /VII semester with no backlog courses up to $(n-1)^{th}$ semester, are only eligible to opt for this flexibility

The list of additional courses offered in the even & odd semesters, registration dates will be notified by the respective departments well in advance.

A student can withdraw from the respective course within 15 days after the commencement of the course.

The choice of utilizing this flexibility is purely optional to the students.

A minimum number of students required to register for an additional course shall be twenty (20). In case, the registered strength for the additional course is less than twenty (20), the course may be offered on the recommendation of the Head of the Department and subsequent approval of the Principal.

8.2 Continuous Internal Evaluation (CIE) for CBCS opted Courses

The contact hours, continuous assessment pattern, eligibility criteria to write end semester examinations and revaluation scheme for these additional courses will be as per the current academic regulations [PVP19].

8.3 Eligibility to appear CBCS registered courses for Semester End Examinations

The registered additional courses will be dealt separately as individual courses for the calculation of attendance and continuous assessment of marks for assessing the eligibility to write the end semester examinations for these courses.

The performance of the student in the registered additional courses will be separately mentioned in the semester end grade card and it will not be taken into account for the calculation of the SGPA for that semester.

The performance of the student in the registered additional courses will be taken into account in the corresponding semesters.

8.4 CBCS Course Detention

8.4.1 In case, the student is detained for want of minimum specified attendance and continuous assessment marks criterion either in the regular semester or in the additional courses, he/she will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration.

8.4.2 In case, the student is detained for want of minimum specified attendance and continuous assessment marks criterion in the regular semester but meets minimum specified attendance and continuous assessment marks criterion in the registered additional courses, he/she shall write the end semester examinations for these additional courses along with the regular students in the corresponding semester only.

8.4.3 In case, the student fails/is absent in the end semester examinations of the registered additional courses or in the regular semester courses in a particular semester, he will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration. They can write the end semester examinations for additional courses in which they failed/were absent, along with regular

students in the corresponding semesters only.

8.4.4 The criterion for the promotion to higher semesters will be as per PVP19 regulations, taking only the regular semester courses into consideration for the fast learners.

8.4.5 Additional courses, in which the fast learning student fails, will not be considered as backlogs for them.

8.4.6 The fast learning students shall register for all the courses of a regular semester excluding the courses completed in the previous semesters.

8.4.7 The credits scored by students through CBCS subjects shall not be considered for credit promotion from II year to III year or from III year to IV year B.Tech.

8.4.8 The student opting for the said flexibility will be considered for the award of the division on par with other regular students.

8.4.9 The students who have earlier history of indulging in malpractices in semester end examinations are not eligible for opting CBCS

8.4.10 If the student fails to register for opted CBCS courses for semester end examination, he/she will forfeit the eligibility for registering additional courses from that semester onwards and marks secured through continuous assessment will not be considered.

8.4.11 The choice of utilizing this flexibility is purely optional to the students.

8.4.12 If a student fails/absent in a CBCS course, he/she is bound to appear in the same course when studied in regular semester.

9. EXAMINATIONS & SCHEME OF EVALUATION

9.1 Description of Evaluation

9.1.1 Continuous Internal Evaluation (CIE): The performance of the student in each course is evaluated by the faculty/course coordinator all through the semester; with mid-term tests (sessional-1and sessional-2), assignments, project reviews, viva-voce, laboratory assessment and other means covering the entire syllabus of the course.

9.1.2 Semester End Examination (SEE): It shall be conducted by chief controller of examinations at the end of each semester, as per the academic calendar and with a written examination for theory courses and practical/project examination with built-in oral part for laboratory/project.

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses

Each course is evaluated for 30 marks (a+b+c)

a) Two assignment tests (Assignment Test-1 & Assignment Test-2) for 10 marks each will be conducted with1 hour duration. Assignment-1 shall be conducted from Unit-1 and Assignment-2 shall be conducted from Unit-4. The assignment test marks shall be awarded taking the average of two

assignment tests.

The Assignment test shall be held in the zero hour and the class work will be conducted as usual in those days.

The Question bank with minimum number of 6 comprehensive questions from the concerned UNIT of the syllabus will be given to students at least a week in advance before the commencement of Assignment Test.

The question paper shall contain 2 comprehensive questions, each one is meant for 5 Marks. The student is required to answer all the questions.

b) Home assignment shall be conducted for 5 marks from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 3 questions from the question bank which will be assigned by the concerned faculty.

c) Two Mid-term (Sessional - 1 and Sessional - 2) examinations with 15 Marks each shall be conducted with **90 minutes** duration.

The Mid-term examinations shall be held in the zero hour and class work shall be conducted as usual in those days.

The Mid-term marks shall be awarded taking the average of two Mid-term examinations.

The question paper shall be given in the following pattern:

Part A: Contains two questions, one from each unit. The student shall answer all questions. Each question is for 2.5 marks.

Part B: Contains four questions. Two questions shall be given from each unit with internal choice. The student shall answer 1 question from each unit. Each question carries 5 marks.

Syllabus for CIE

Name of the Test	**Syllabus**
Assignment Test – 1	UNIT – I
Sessional – 1	UNIT - I & UNIT – II
Home Assignment	UNIT – III
Assignment Test – 2	UNIT – IV
Sessional – 2	UNIT – IV& UNIT – V

The questions shall be framed in Assignment tests and Sessional examinations in line with the Course Outcomes defined and cognitive levels.

9.2.2 Mandatory Learning Courses

Each course is evaluated for 100 marks (a+b)

a) Two Mid-term (Sessional - 1 and Sessional - 2) examinations each for 40 Marks shall be conducted with **90 minutes** duration.

The Mid-term examinations shall be held in the zero hour and the class work shall be conducted as usual in those days.

The question paper shall be given in the following pattern:
The question paper contains four questions. Two questions shall be given from each unit with internal choice. The student shall answer one question from each unit. Each question carries 20 marks.

b) Home assignment for 20 marks shall be conducted from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 4 questions from the question bank which will be assigned by the concerned faculty.

The Mid-term marks shall be awarded as sum of two Mid-term examinations and home assignment.

Syllabus for CIE

Name of the Test	**Syllabus**
Sessional – 1	UNIT – I & II
Home Assignment	UNIT – III
Sessional – 2	UNIT – IV & V

9.2.3 Laboratory Courses

For Laboratory courses, there shall be continuous evaluation during the semester for 25 marks and semester end evaluation for 50 marks. The distribution of marks for continuous internal evaluation is given in the Table 2:

Table 2: Distribution of Marks (CIE)

S. No.	**Criterion**	**Marks**
1	Day to Day work	10
2	Record	05
3	Internal Exam	10

9.2.4 Project Phase I

For Project Phase I, there shall be continuous internal evaluation during the semester for 100 marks. The continuous internal evaluation for the Project Phase I shall be on the basis of day to day assessment by the project guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of the Department, Programme Coordinator, Senior Faculty member of the department and Project guide. The distribution of continuous internal evaluation marks is given in the Table 3:

Table 3: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Assessment	40
2	Two Reviews	30+30

9.2.5 Project Phase II

For Project Phase II, there shall be continuous internal evaluation during the semester for 100 marks and semester end evaluation for 100 marks. The continuous internal evaluation for the Project Phase II shall be on the basis of day to day assessment by the project guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of the Department, Programme Coordinator, Senior Faculty member of the department and Project guide. The distribution of marks is given in the Table 4:

Table 4: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Assessment	40
2	Two Reviews	30+30

9.2.6 MOOCs Courses

Students who have qualified in the examination conducted by the MOOCs providers as specified in 7.2.2 are exempted from appearing in the continuous and semester end evaluations conducted by the institution.

In case, a student fails to complete the MOOCs course offered by MOOC's providers, he/she may be allowed to register again for the same with any of the

providers from the list provided by the department or the student may be allowed to register for the course as and when offered by the college as supplementary candidate.

Students Registered and cleared the opted courses in MOOC's are exempted from appearing Semester end examinations conducted by the Institute.

The Scheme of Evaluation for MOOCs courses shall be scaled to continuous internal evaluation as 30 marks and semester end examination as 70 marks.

9.3 Semester End Examination

9.3.1 Theory Courses : 70 Marks

The Semester end examination shall be conducted with 3 hours duration at the end of the semester. The question paper shall be given in the following pattern:

a) **Part A:** Contains 5 questions of 2 marks each to test the knowledge level of the student. One question shall be given from each unit of the prescribed syllabus included in five units. The student shall answer all questions.

b) **Part B:** Contains 10 questions. Two questions from each unit shall be given with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The student shall answer one question from each unit.
The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

9.3.2 Laboratory Courses: 50 marks

i. The Semester end examination for laboratory courses shall be conducted with three hour duration at the end of semester for 50 marks as given below:

Table 5: Distribution of Marks (SEE)

S.No.	Criterion	Marks
1	Procedure	10
2	Experiment/Programme Execution	20
3	Result	10
4	Viva-Voce	10

ii. Each Semester end Laboratory Examination shall be conducted by an External Examiner along with the Internal Examiner.

9.3.3 Project Phase II: 100 marks

The semester end examination for project phase II shall be held for 100 marks by a committee consisting of an external examiner, Head of the Department, Programme coordinator and Project guide. The evaluation of the project work shall be conducted at the end of the VIII Semester.

The average of the marks awarded by the committee members shall be taken into consideration in case of variation among the members.

The evaluation of 100 marks is distributed as given in Table 6:

Table 6: Distribution of Marks in Project Phase II

Sl. No.	Criterion	Marks
1	Report	40
2	Presentation	30
3	Viva –Voce	30

9.3.4 Internship/Industry Interaction: 75 Marks

a) Internships :

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 75 marks by the Review Committee consisting of Head of the department, Programme Coordinator and Concerned Industry Representative/ Industry Institute Interaction Coordinator.

b) Industry Offered Courses:

The semester end examination for the courses under this category is evaluated for 75 marks and it shall be conducted and evaluated by the industry expert who has delivered the lecture or by the faculty nominated by the head of the department in consultation with the industry expert. The question paper pattern shall be decided by the industry expert at the beginning of the course and the same is to be approved by the Principal.

There will not be continuous internal evaluation for the courses under this category.

9.4 Conditions for Pass Marks

9.4.1 A candidate shall be declared to have passed in individual theory/drawing

course if he/she secures a minimum of 40% aggregate marks (Continuous Internal Evaluation & Semester End Examination marks put together), subject to a minimum of 35% marks in semester end examination.

9.4.2 A candidate shall be declared to have passed in individual laboratory course/project if he/she secures a minimum of 50% aggregate marks (Continuous Internal Evaluation &Semester End Examination marks put together), subject to a minimum of 40% marks in semester end examination.

9.4.3 Mandatory Courses are assessed for PASS or FAIL only. No grade will be assigned to these courses. If a candidate secures more than 40 out of 100 marks, he / she will be declared PASS or else FAIL.

9.4.4 Mandatory courses NCC/NSS/NSO/YOGA are assessed for satisfactory or not satisfactory only. No grade will be assigned. A candidate has to undergo two hours training per week in any one of the above in both I and II semesters.

9.4.4 The student has to get pass marks in the failed course by appearing the supplementary examination as per the requirement for the award of degree.

9.4.5 The student shall earn assigned credits for the course on passing a course of a programme,.

9.5 Revaluation

9.5.1 Continuous Internal Evaluation

The continuous Evaluation scripts shall be shown to the students before finalizing the marks. However, if the student has any concern, not addressed before the finalization of marks, he/she may submit the application for revaluation to the concerned head of the department.

The Head of the Department may constitute a two member committee for re-evaluating the script. The evaluation of the committee is final and binding.

9.5.2 Semester End Examination

1. As per the notification issued by the Controller of Examinations, the students can submit the applications for revaluation, along with the requisite fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with the marks obtained.
2. The Controller of Examinations shall arrange for re-evaluation of those answer script(s).
3. A new external examiner, other than the first examiner, shall re-evaluate the answer script(s).

4 Revaluation marks will be taken into consideration only if the difference between the two valuations is more than or equal to 15%. Better marks between the two shall be taken into consideration. However, if the revaluation marks facilitates passing of the candidate, then the revaluation marks will be considered even if the difference of marks is less than 15%.

5 If the difference of marks between the two valuations is more than 20%, the answer script will be referred to third valuation. The average of nearest two marks will be awarded.

9.6 Withholding of Results

If the student has not paid the dues to the college, or if any case of malpractice or indiscipline is pending against him, the result of the student will be kept as withheld and he/she will not be allowed to enter the next semester. His/her degree shall be considered as withheld in such cases.

10 CRITERIA TO ATTEND SEMESTER END EXAMINATIONAND PROMOTION TO HIGHER SEMESTER

10.1 Eligibility for Semester End Examinations

10.1.1 Students shall put in a minimum average attendance of 75% in the courses from category 7.2.1 to 7.2.6 put together, computed by totaling the number of periods of lectures, tutorials, drawing, practical and project work as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator, to be eligible to write semester end examinations.

10.1.2 Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

10.1.3 Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.

10.2 Conditions for Promotion

10.2.1 A student shall be eligible for promotion to next Semester of B.Tech. programme, if he/she satisfies the conditions as stipulated in Regulations **10.1.**

10.2.2 Further, a student shall be eligible for promotion to V / VII Semester of B.Tech. programme, if he/she completes the academic

requirements of 50% of the credits upto IV/ VI semesters.

10.2.3 Promotion to V Semester

For Four Year B.Tech Course candidates

A four year programme student shall be promoted from IV semester to V semester only if he/she earns 50% credits of the designed programme credits from I semester to IV semester.

10.2.4 Promotion to VII Semester

i) For Four Year B.Tech Course candidates

A four year programme student shall be promoted from VI semester to VII semester only if he/she earns 50% credits of the designed programme credits from I semester to VI semester.

ii) For Lateral Entry candidates

A lateral entry student shall be promoted from VI semester to VII semester only if he/she earns 50% credits of the designed programme credits from III semester to VI semester.

10.2.5 For Detained Students

a) Students who are already detained for want of credits shall be promoted to **V Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinations held upto IV Semester till the commencement of next academic year.

b) Students who are already detained for want of credits shall be promoted to **VII Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinations held upto VI Semester till the commencement of next academic year.

11. SUPPLEMENTARY EXAMINATIONS

11.1 General

Semester end Supplementary examinations shall be conducted along with regular semester end examinations.

11.2 Advanced Supplementary Exams

Candidate(s), who fails in Theory or Laboratory courses of VIII semester, can appear for advanced supplementary examination conducted within one month after declaration of the revaluation results. However, those candidates who fail in the advanced

supplementary examinations of VIII semester shall appear for subsequent examinations along with regular candidates conducted at the end of the respective academic year.

12. READMISSION CRITERIA

A candidate, who is detained in a semester due to lack of attendance/credits, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of **Rs. 1,000/-**

Rules for calculation of attendance for readmitted students

a) Number of classes conducted shall be counted from the commencement day of the semester concerned, irrespective of the date of payment of tuition fee.

b) They shall submit a written request to the principal of the college, along with a challan paid towards tuition and other fee, for readmission before the commencement of the classwork.

c) They can get the information regarding date of commencement of class work for each semester that will be made available in the college notice boards/website from time to time.

13. BREAK IN STUDY

Student, who discontinues the studies for valid reason permitted by the principal, shall get readmission into appropriate semester of B.Tech. programme after break-in study, with the prior permission of the Principal and following the transitory regulations applicable to such batch in which he/she joins. An administrative fee of **Rs**. 1**000/-**per each year of break in study, in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

14. TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on re-admission, the academic regulations under which he/she has originally admitted will continue to be applicable to him/her on re-admission.

15. ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

15.1 The B.Tech. Degree shall be conferred on a candidate who satisfies the following requirements.

15.1.1 A Regular student (four year programme) shall register and secure himself/herself for **160** Credits from the categories 7.2.1 to 7.2.6

15.1.2 A Lateral Entry student (three year programme) shall register and secure himself/herself for **121.5** credits from the categories 7.2.1 to7.2.6

15.2 Award of Division

The criteria for award of division, after successful completion of programme is as shown in table 6

Table 6: Criteria for Award of Division

CGPA	DIVISION
≥7.5	First Class with distinction*
≥6.5 - <7.5	First Class
≥5.5 - <6.5	Second Class
≥5.0 - <5.5	Pass Class
<5.0	Fail

* Awarded only if all the courses prescribed are cleared in single attempt within four years for regular candidates and three years for lateral entry candidates

* Detained and break-in study candidates are not eligible for the award of First Class with Distinction

* The cases of students who are absent for semester end examination only once in his/her duration of B.Tech. programme on valid medical grounds/humanitarian grounds shall also be considered for the award of First class with Distinction subject to the recommendations of the committee constituted by the Principal.

For the purpose of awarding First, Second and Pass Class CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the programme shall be considered.

15.3 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the students will be issued after successful completion of the four year B.Tech Programme.

16. CONDUCT AND DISCIPLINE

16.1 Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institution.

16.2 As per the order of Honorable Supreme Court of India and AICTE guidelines, ragging in any form is considered a criminal offence and is

banned. Ragging within or outside any educational institution is prohibited. Ragging means doing an act, that causes or is likely to cause insult or annoyance or fear of apprehension or threat or intimidation or outrage of modesty or injury to a student. Any form of ragging will be severely dealt with as per AP Prohibition of Ragging Act-1997 section-4.

Table – 7: Punishments for Ragging

Nature of ragging	Punishment
Teasing, embarrassing and humiliating	Imprisonment upto 6 months or fine upto Rs.1,000/- or both
Assaulting or using criminal force or criminal intimidation	Imprisonment upto 1 year or fine upto Rs.2,000/- or both
Wrongfully restraining or confining or causing hurt	Imprisonment upto 2 years or fine upto Rs.5,000/- or both
Causing grievous hurt kidnapping or raping or committing unnatural offence	Imprisonment upto 5 years and fine upto Rs.10,000/-
Causing death or abetting suicide	Imprisonment upto 10 years and fine upto Rs.50,000/-

16.3 A student who is convicted of an offence and punished with imprisonment for a term of more than six months shall not be admitted into the institution.

16.4 Whenever any student complains of ragging to the head or manager of an educational institution, such head or manager should inquire into the complaint and if the complaint is prima-facie found true, should suspend the student or students complained against.

16.5 If the head or manager of an educational institution fails or neglects to take action in the manner specified in the Act, the person shall be deemed to have abetted the offence and shall be punished with the punishment provided for the offence.

16.6 If a student commits suicide due to or in consequence of ragging, the person who commits such ragging shall be deemed to have abetted such suicide.

The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures.

i. Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.

ii. Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

The following activities are not allowed within the campus:

- Mutilation or unauthorized possession of library books.
- Noisy and unseemly behaviour, disturbing studies of fellow students.
- Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cybercrime etc.)
- Use of mobile phones.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the Institute from time to time.
- Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- For an offence committed in (i) a hostel, (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.
- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and break-in-study candidates are allowed into the campus for academic purposes only with the permission from authorities.
- Misconduct committed by a student outside the Institute campus but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature and gravity of such misconduct.

- The disciplinary action committee constituted by the Principal, shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.
- Grievance redressal committee, constituted by the Principal, shall deal with all grievances pertaining to the academic/ administrative and disciplinary matters.
- All the students must abide by the code and conduct rules of the Institute.

17 MALPRACTICES

The Principal shall refer the cases of malpractices by students in internal assessment tests and end semester examinations, to a malpractice enquiry committee constituted for the purpose. The committee shall follow the approved scales of punishment.

The committee consists of:

1. Heads of Department (Three)
2. Controller of Examinations
3. Deputy Controller of Examinations

Table – 8: Disciplinary action for malpractices/improper conduct in examinations

	Nature of Malpractices/Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible, any paper, note book, programmable calculators, mobile phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in the examination hall but has not made use of (material shall include any marks on the student's body that can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through mobile 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	If the candidate 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	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. He shall not be permitted to

	examination (theory or practical) in which the candidate is appearing.	appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the candidate is to be cancelled.
3	If the candidate 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	If the candidate smuggles in an 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 other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate 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	If the candidate 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	In case of students of the Institute, 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.

	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 results in damage to or destruction of property in the examination hall or any part of the Institute campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7	If the candidate 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 other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses 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 Institute, who is not a candidate for the particular examination or any person not connected with the Institute indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the Institute: 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. He 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 Institute: Will be handed over to police and a police case will be registered against them.

10	If the candidate 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. He 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 awarded suitable punishment.	

Note: Special squads may be formed to oversee the proper conduct of examinations.

18 OTHER MATTERS

18.1 Scribe facility is extended to B Tech students strictly following the guidelines issued under F. No. 16-110/2003-DD.III Dt. 26-02-2013 by the Ministry of Social Justice and Empowerment, Department of Disability Affairs, Govt. of India.

18.2 Students who are suffering from contagious diseases are not allowed to appear either continuous internal assessment or semester end examinations.

18.3 The students who participate in coaching/tournaments held at State/National/International levels through University/Indian Olympic Association during semester end examination period will be promoted to subsequent semesters till the entire programme is completed as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated18-08-1994.

18.4 Based on the recommendations of HOD & Principal, exemption from attending the class work shall be given to those students who secure placement and intend to join as the employer in VIII semester of B.Tech. Special Continuous Internal Evaluation (Assignment Tests, Sessional, etc.,) will be arranged to such candidates separately if necessary.

However, they shall appear for Semester End Examinations as per the Academic Calendar

18.5 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the

Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved in the Heads of the Departments Meetings, shall be reported to the academic council for ratification.

19 GENERAL

1 Wherever the words "he", "him", "his", occur in the regulations, they may include "she", "her", "hers".

2 The academic regulations should be read as a whole for the purpose of any interpretation.

3 In case of any doubt or ambiguity in the interpretation of above rules, the decision of the principal is final.

20 INSTITUTE RULES AND REGULATIONS

1 Use of **Mobile phones** is strictly prohibited inside the Institute academic area.

2 Students should come to Institute in **proper dress**.

3 All students should wear **identity cards** in the Institute premisis.

4 Students should be present in their respective classrooms **before the commencement of class sharply**.

5 Students should not leave the Institute premises without prior permission of their respective Heads of the departments during Institute working hours.

6 Students should maintain silence in the class rooms during working periods.

7 Sitting / wandering of the students at the stair cases, corridors, cycle stands or the areas within the Institute premises is strictly prohibited.

8 Usage of Vehicle horn inside the Institute premises is prohibited.

21 AMENDMENTS TO REGULATIONS

The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and/or syllabi.

Oratory

PRINCIPAL

B.Tech
COURSE STRUCTURE

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1101	Communicative English I	2	0	0	2	30	70	100
19BS1101	Engineering Mathematics I (Calculus and Algebra)	3	0	0	3	30	70	100
19BS1103	Engineering Chemistry	3	0	0	3	30	70	100
19ES1102	Problem Solving and Programming	3	1	0	4	30	70	100
19HS1151	Communicative English I Lab	0	0	3	1.5	25	50	75
19BS1152	Engineering Chemistry Lab	0	0	3	1.5	25	50	75
19ES1152	Problem Solving and Programming Lab	0	0	3	1.5	25	50	75
19ES1153	Basic Workshop	0	0	3	1.5	25	50	75
19MC1151	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100		100
	Total	11	1	14	18	320	480	800

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1201	Communicative English II	2	0	0	2	30	70	100
19BS1202	Engineering Mathematics II (Probability and Statistics)	3	0	0	3	30	70	100
19BS1205	Engineering Physics	3	0	0	3	30	70	100
19ES1201	Basic Electrical and Electronics Engineering	3	1	0	4	30	70	100
19ES1203	Engineering Graphics	1	0	3	2.5	30	70	100
19HS1251	Communicative English II Lab	0	0	3	1.5	25	50	75
19BS1253	Engineering Physics Lab	0	0	3	1.5	25	50	75
19ES1251	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	25	50	75
19CS3251	Information Technology Workshop	0	0	3	1.5	25	50	75
19MC1251	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100		100
	Total	12	1	17	20.5	350	550	900

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

II B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19BS1302	Engineering Mathematics III (Discrete Mathematical Structures)	3	0	0	3	30	70	100
19BS1303	Life Sciences for Engineers	2	0	0	2	30	70	100
19ES1302	Design Thinking & Product Innovation	2	0	0	2	30	70	100
19CS3301	Fundamentals of Digital Logic Design	3	0	0	3	30	70	100
19CS3302	Object Oriented Programming	2	0	0	2	30	70	100
19CS3303	Data Communication	2	0	0	2	30	70	100
19CS3304	Data Structures	3	1	0	4	30	70	100
19MC1301	Environmental Sciences	3	0	0	0	100		100
19BS1351	Life Sciences for Engineers Lab	0	0	2	1	25	50	75
19ES1352	Design Thinking & Product Innovation Lab	0	0	2	1	25	50	75
19CS3351	Object Oriented Programming Lab	0	0	2	1	25	50	75
19CS3352	Data Structures Lab	0	0	3	1.5	25	50	75
	Total	20	1	9	22.5	410	690	1100

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

II B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19BS1403	Engineering Mathematics-IV (Number Theory and Cryptography)	3	0	0	3	30	70	100
19ES1401	AI Tools	2	0	0	2	30	70	100
19CS3401	Computer Organization and Architecture	3	0	0	3	30	70	100
19CS3402	Operating Systems	3	0	0	3	30	70	100
19CS3403	Computer Networks	3	0	0	3	30	70	100
19CS3404	Design and Analysis of Algorithms	3	0	0	3	30	70	100
19MC1402	Constitution of India	3	0	0	0	100		100
19ES1451	AI Tools Lab	0	0	2	1	25	50	75
19CS3451	Computer Networks Lab	0	0	2	1	25	50	75
19CS3452	Design and Analysis of Algorithms Lab	0	0	2	1	25	50	75
19CS3453	Python Programming	0	0	2	1	25	50	75
	Total	20	0	8	21	380	620	1000

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19ES1501	Internet of Things	2	0	0	2	30	70	100
19CS3501	Software Engineering	3	0	0	3	30	70	100
19CS4501	Program Elective-I	3	0	0	3	30	70	100
19CS3502	Formal Languages and Automata Theory	3	0	0	3	30	70	100
19CS3503	Database Management Systems	3	0	0	3	30	70	100
	Interdisciplinary Elective I	3	0	0	3	30	70	100
	Open Elective I	3	0	0	3	30	70	100
19ES1552	Internet of Things Lab	0	0	2	1	25	50	75
19CS3551	Software Engineering Lab	0	0	2	1	25	50	75
19CS3552	Database Management Systems Lab	0	0	2	1	25	50	75
	Total	20	0	6	23	285	640	925

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1601	Engineering Economics and Management	3	0	0	3	30	70	100
19CS3601	Compiler Design	3	0	0	3	30	70	100
19CS4601	Program Elective-II	3	0	0	3	30	70	100
19CS3602	Machine Learning	3	0	0	3	30	70	100
19CS4602	Program Elective-III	3	0	0	3	30	70	100
19CS3603	Web Application Development	2	0	0	2	30	70	100
19MC1601	Engineering Ethics	3	0	0	0	100		100
	Open Elective II	3	0	0	3	30	70	100
19CS3651	Compiler Design Lab	0	0	2	1	25	50	75
19CS3652	Web Application Development Lab	0	0	2	1	25	50	75
	Total	23	0	4	22	360	590	950

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

IV B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1701	Organization Behavior	3	0	0	3	30	70	100
19CS3701	Mobile Application Development	3	0	0	3	30	70	100
19CS4701	Program Elective-IV	3	0	0	3	30	70	100
19CS4702	Program Elective-V	3	0	0	3	30	70	100
	Interdisciplinary Elective II	3	0	0	3	30	70	100
19CS3751	Mobile Application Development Lab	0	0	2	1	25	50	75
19CS3761	Project Phase-I	0	0	4	2	100		100
19CS3771	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	0	0	0	2	75		75
	Total	15	0	6	20	350	400	750

IV B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19CS4801	Program Elective-VI	3	0	0	3	30	70	100
	Inter Disciplinary Elective III	3	0	0	3	30	70	100
19CS3861	Project Phase-II	0	0	14	7	100	100	200
	Total	6	0	14	13	160	240	400

Program Elective-I

S. No	Course Title	Category	L	T	P	C
1	Advanced Data Structures	PE	3	0	0	3
2	Advanced Computer Networks	PE	3	0	0	3
3	Software Requirements Management	PE	3	0	0	3
4	Distributed Systems	PE	3	0	0	3

Program Elective-II

S. No	Course Title	Category	L	T	P	C
1	Soft Computing	PE	3	0	0	3
2	Cryptography and Information Security	PE	3	0	0	3
3	Design Patterns	PE	3	0	0	3
4	Unix Operating Systems	PE	3	0	0	3

Program Elective-III

S. No	Course Title	Category	L	T	P	C
1	Neural Networks	PE	3	0	0	3
2	Cyber Security	PE	3	0	0	3
3	Software Metrics	PE	3	0	0	3
4	Cloud Computing	PE	3	0	0	3

Program Elective-IV

S. No	Course Title	Category	L	T	P	C
1	Deep Learning	PE	3	0	0	3
2	Adhoc and Sensor Networks	PE	3	0	0	3
3	Agile Software Development	PE	3	0	0	3
4	Parallel Computing	PE	3	0	0	3

Program Elective-V

S. No	Course Title	Category	L	T	P	C
1	Big Data	PE	3	0	0	3
2	Cyber Forensics	PE	3	0	0	3
3	Software Testing Methodologies	PE	3	0	0	3
4	Fundamentals of Block Chain Technology	PE	3	0	0	3

Program Elective-VI

S. No	Course Title	Category	L	T	P	C
1	Natural Language Processing	PE	3	0	0	3
2	Advances in Internet of Things	PE	3	0	0	3
3	Secure Software Engineering	PE	3	0	0	3
4	Big Data	PE	3	0	0	3

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Inter Disciplinary Electives

Offered By	Subject	Course Code	Title	L	T	P	Credits	Internals	Externals	Total
CSE	Inter Disciplinary Elective-I	19CS2501C	Data Base Management Systems	3	0	0	3	30	70	100
MBA	Inter Disciplinary Elective-I	19HS2501C	Quantitative Techniques for Management	3	0	0	3	30	70	100
IT	Inter Disciplinary Elective-I	19IT2501C	OOP with C++	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-I	19ME2501A	Computational methods	3	0	0	3	30	70	100
EEE	Inter Disciplinary Elective-II	19EE2701C	Renewable Energy Resources	3	0	0	3	30	70	100
IT	Inter Disciplinary Elective-II	19IT2701C	Web Technologies	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-II	19ME2701B	Optimization Techniques	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-II	19ME2701C	Project Management & Optimization	3	0	0	3	30	70	100
CSE	Inter Disciplinary Elective-III	19CS2801D	Introduction to Python Programming	3	0	0	3	30	70	100
ECE	Inter Disciplinary Elective-III	19EC2801B	Instrumentation and Sensor Technologies of Civil Engineering Applications	3	0	0	3	30	70	100
MBA	Inter Disciplinary Elective-III	19HS2801A	Logistics and Supply Chain Management	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-III	19ME2801B	Total Quality Management	3	0	0	3	30	70	100

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(Effective from Academic Year 2019-20)

Open Electives

Subject	Course Code	Title	L	T	P	Credits	Internals	Externals	Total
Open Elective I	19ES5501A	Biotechnology and Society	3	0	0	3	30	70	100
Open Elective I	19ES5501B	Electrical Safety	3	0	0	3	30	70	100
Open Elective I	19ES5501C	Fundamentals of Cyber Law	3	0	0	3	30	70	100
Open Elective I	19ES5501D	Environment and Ecology	3	0	0	3	30	70	100
Open Elective I	19HS5501A	Contemporary Relevance of Indian Epics	3	0	0	3	30	70	100
Open Elective I	19HS5501B	Indian National Movement	3	0	0	3	30	70	100
Open Elective I	19HS5501C	Engineering for Community Service	3	0	0	3	30	70	100
Open Elective I	19HS5501D	Personality Development	3	0	0	3	30	70	100
Open Elective I	19HS5501E	Introduction to International Business	3	0	0	3	30	70	100
Open Elective I	19HS5501F	Gandhian Philosophy	3	0	0	3	30	70	100
Open Elective I	19HS5501G	Indian History	3	0	0	3	30	70	100
Open Elective II	19ES5601A	Environmental Management	3	0	0	3	30	70	100
Open Elective II	19ES5601B	Telecommunication for Society	3	0	0	3	30	70	100
Open Elective II	19HS5601A	German for Beginners	3	0	0	3	30	70	100
Open Elective II	19HS5601B	Chinese for Beginners	3	0	0	3	30	70	100
Open Elective II	19HS5601C	Analytical Essay Writing	3	0	0	3	30	70	100
Open Elective II	19HS5601D	Indian Economy	3	0	0	3	30	70	100
Open Elective II	19HS5601E	Public Administration	3	0	0	3	30	70	100
Open Elective II	19HS5601F	National Service Scheme	3	0	0	3	30	70	100
Open Elective II	19HS5601G	Professional Communication	3	0	0	3	30	70	100
Open Elective II	19HS5601H	Basics of Finance	3	0	0	3	30	70	100
Open Elective II	19HS5601I	Basics of Marketing	3	0	0	3	30	70	100

Communicative English - 1

Course Code	19HS1101	Year	I	Semester	I
Course Category	Humanities	Branch	CSE	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Comprehend how to apply parts of speech in a sentence and construct a paragraph.
CO2	Apply grammar to formulate text using punctuation.
CO3	Evaluate reading texts and use correct tense forms for effective communication.
CO4	Analyze reading texts and to write summaries based on comprehension of the texts.
CO5	Create awareness on how to write correct sentences in English and comprehend the text.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		3		1
CO2										3		3		1
CO3										3		3		1
CO4										3		3		1
CO5										3		3		1

Syllabus		
Unit No.	Contents	Mapped CO
I	**Reading:** Skimming to get the main idea of a text; Scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - Introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; Word forms: Verbs, Nouns, Adjectives and Adverbs; Nouns: countables and uncountables; singular and plural; Basic sentence structures; Simple question form - wh-questions; Word order in sentences.	CO1
II	**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; Mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; Use of articles and zero article; prepositions	CO2
III	**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - Tenses; Subject-verb agreement; Direct and	CO3

	indirect speech, Reporting verbs for academic purposes.	
IV	**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Degrees of comparison; Use of antonyms	CO4
V	**Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – Identifying and correcting common errors in grammar and usage (Articles, prepositions, Tenses, Subject-verb agreement)	CO5

Learning Resources
Text Books
Prabhavathy Y, M.Lalitha Sridevi, Ruth Z. Hauzel, "English all round communication skills for undergraduate students", Orient Black Swan, 2019
Reference Books
1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012
e-Resources & other digital material
Grammar/Listening/Writing 1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online; http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/; http://www.nonstopenglish.com/ https://www.vocabulary.com/; BBC Vocabulary Games Free Rice Vocabulary Game Reading https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/ All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner"s dictionaries

Engineering Mathematics – 1 (Calculus and Algebra)

Course Code	19BS1101	Year	I	Semester	I
Course Category	Basic Sciences	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	utilize the techniques of matrix algebra that is needed by engineers for practical applications
CO2	apply mean value theorems to engineering problems
CO3	utilize functions of several variables in optimization
CO4	employ the tools of calculus for calculating the areas
CO5	calculate volumes using multiple integrals

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											1	2
CO2	3	2											1	2
CO3	3	2											1	2
CO4	3	2											1	2
CO5	3	2											1	2

Syllabus

Unit No.	Contents	Mapped CO
I	Matrices: Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations. Eigen values, Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.	CO1
II	Mean Value Theorems:Rolle,,s Theorem, Lagrange,,s mean value theorem, Cauchy,,s mean value theorem, Taylor,,s and Maclaurin,,s theorems with remainders (without proof).	CO2
III	Multivariable Calculus :Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.	CO3
IV	Multiple Integrals-I :Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.	CO4
V	Multiple Integrals-II: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volume as triple integral.	CO5

Learning Resources
Text Books
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017 2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018
Reference Books
1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002. 2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013. 3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
e-Resources & other digital material
1. www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/111104025/ 3. https://nptel.ac.in/courses/122101003/

Engineering Chemistry

Course Code	19BS1103	Year	I	Semester	I
Course Category	Basic Sciences	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	30	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	List various sources of renewable energy.
CO2	Compare different types of cells.
CO3	Explain the merits of fuel cells.
CO4	Identify suitable methods for metal finishing.
CO5	Distinguish between nanoclusters and nanowires, polymers, molecular machines & switches

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													1
CO3	3		2											
CO4	3		2											1
CO5	3													1

Syllabus

Unit No.	Contents	Mapped CO
I	ELECTROCHEMICAL ENERGY SYSTEMS Introduction-Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell, Types of Electrodes or Half Cells-Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, Electrochemical conventions, Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (classification only), Concentration Cells.	CO1
II	BATTERY TECHNOLOGY Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries- zinc air, lithium cells-Li MnO_2 cell- challenges of battery technology. Fuel cells- Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.	CO2
III	RENEWABLE SOURCES OF ENERGY Introduction- sources of renewable energy Solar energy – Introduction - Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz - Doping of Silicon- p and n	CO3

	type semi conductors- PV cell / solar cell- Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique-applications of solar energy	
IV	METAL FINISHING Technological importance of metal finishing, methods of metal finishing, manufacturing of electronic components, electrochemical techniques of forming, machining and etching, electrolytic cell, principle of electroplating, nature of electrodeposits, electroplating process, Electroplating of chromium, gold etc. Electroless plating of copper, nickel	CO4
V	POLYMERS, NANOMATERIALS AND MOLECULAR MACHINES & SWITCHES: Polymers: Introduction thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Polyphosphazines., differences between Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: sol- gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM). Molecular machines & Molecular switches: Rotaxanes and Catenanes as artificial molecular machines; Molecular switches – cyclodextrin-based switches	CO5

Learning Resources
Text Books
1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, DhanapatRai& Sons, Delhi (2014). 2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut. 3. O G Palanna, Engineering Chemistry, Tata McGraw Hill (2009).
Reference Books
1. Sashichawla, A Textbook of Engineering Chemistry, DhanapathRai and sons, (2003) 2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013). 3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010) 4. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, M murthyPublications (2014). 5. K. SeshaMaheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, (2016).
e-Resources & other digital material
https://nptel.ac.in/courses/105105178/ http://202.53.81.118/course/view.php?id=82

Problem Solving and Programming

Course Code	19ES1102	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	CSE	Course Type	Theory
Credits	4	L-T-P	3-1-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Develop algorithm and flowchart for simple problems.
CO2	Understand the structure, fundamentals and decision making statements in C.
CO3	Choose suitable iterative statements and arrays to solve the problems.
CO4	Solve problems using functions and pointers.
CO5	Apply the structures, unions and file operations in a specific need.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2										1	3	3
CO2	1	1											3	3
CO3	2	2	2									1	3	3
CO4	2	2	2									1	3	3
CO5	2	2	2									1	3	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Introduction to Computer Problem-Solving – Introduction, The Problem-Solving Aspect, Top-Down Design, Fundamental Algorithms – Exchanging the values of two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci Series. Basics of Flow charts.	CO1
II	**Introduction to C:** Introduction, Structure of C Program, A Simple C Program, C-Tokens, Basic Data types, Variables, Constants, Input / Output statements, Operators, Type conversion and Type casting. **Conditional Branching Statements:** if, if-else, if-else-if Statements and Switch case.	CO2
III	**Iterative Statements:** while, for and do - while loops, Nested loops, break and continue statements. **Arrays:** Declaration, Accessing array elements, Storing values, Operations on arrays, Multi-dimensional arrays. **Strings:** Introduction, String manipulation functions.	CO3
IV	**Functions:** Introduction, Using Functions, Function declaration, Function	CO4

	definition and Function call, Parameter passing, Passing arrays to functions, Recursion, Storage classes. **Pointers:** Declaration and Initialization of pointer variables, Pointer arithmetic, Pointers and arrays, Pointer to pointer, Array of pointers, Pointers and functions, Dynamic memory allocation.	
V	**Structures:** Introduction, Nested structures, Array of structures, Structures and functions, Unions. **Files in C:** Using Files in C, Read data from files, Writing data to files, Random access to files of records.	CO5

Learning Resources
Text Books
1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006. (for Unit I). 2. Reema Thareja , Programming in C, Oxford University Press, AICTE Edition, 2018.
Reference Books
1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007. 2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition, 3. B. Gottfried, Programming with C, 3/e, Schaum‟s outlines, McGraw Hill (India), 2017. 4.Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e-Resources & other digital material
1. http://cprogramminglanguage.net/ 2. https://www.geeksforgeeks.org/c-programming- language/ 3. https://nptel.ac.in/courses/106105085/4

Communicative English – 1 Lab

Course Code	19HS1151	Year	I	Semester	I
Course Category	Humanities	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO2	Apply communication skills through various language learning activities
CO3	Analyze the comprehensive ability and logical thinking for better listening and speaking.
CO4	Evaluate and exhibit acceptable etiquette essential in social and professional situations.
CO5	Create awareness on how to improve presentation skills in English.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3		3	1	
CO2									2	3		3	1	
CO3									2	3		3	1	
CO4									2	3		3	1	
CO5									2	3		3	1	

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.	CO1
II	Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.	
III	Answering a series of questions about main idea and supporting ideas after listening to audio texts.	CO2
IV	Discussion in pairs/ small groups on specific topics followed by short structured talks.	
V	Listening for global comprehension and summarizing what is listened to.	CO3
VI	Discussing specific topics in pairs or small groups and reporting what is discussed	
VII	Making predictions while listening to conversations/transactional dialogues without video; listening with video.	CO4
VIII	Role plays for practice of conversational English in academic contexts	

	(formal and informal) - asking for and giving information/directions.	
IX	Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.	CO5
X	Formal oral presentations on topics from academic contexts -without the use of PPT slides.	

Learning Resources
Reference Books
1. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
e-Resources & other digital material
Grammar/Listening/Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Listening https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/BBC; Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner‟s dictionaries

Engineering Chemistry Lab

Course Code	19BS1152	Year	I	Semester	I
Course Category	Basic Sciences	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods.
CO2	Identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods).
CO3	Experiment with the physical parameter of organic compounds.
CO4	Compare the viscosities of oils.
CO5	List the preparation of polymers and nano materials.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2											
CO2	3		2											
CO3	3		2											
CO4	3		2											
CO5	3		2											

Syllabus

Expt. No.	Contents	Mapped CO
I	Determination of strength of an acid by pH metric method	CO1
II	Determination of conductance by conductometric method	
III	Determination of viscosity of a liquid	CO4
IV	Determination of surface tension of a liquid	CO3
V	Determination of chromium (VI) in potassium dichromate	CO2
VI	Determination of Zinc by EDTA method	
VII	Estimation of active chlorine content in Bleaching powder	CO3
VII	Preparation of Phenol-Formaldehyde resin	CO5
IX	Preparation of Urea-Formaldehyde resin	
X	Thin layer chromatography	CO3

Learning Resources

Text Books

N.KBhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, DhanpatRai Publishing Company (2007).

Reference Books

Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel‟s Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
e-Resources & other digital material
https://nptel.ac.in/courses/105105178/ http://202.53.81.118/course/view.php?id=82

Problem Solving and Programming Lab

Course Code	19ES1152	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Build algorithm and flowchart for simple problems.
CO2	Use suitable control structures to solve problems.
CO3	Use suitable iterative statements and arrays to solve the problems.
CO4	Implement Programs using functions and pointers.
CO5	Develop code for complex applications using structures, unions and file handling features.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2										1	3	3
CO2	2	2	2		2							1	3	3
CO3	2	2	2		2							1	3	3
CO4	2	2	2		2							1	3	3
CO5	2	2	2		1							1	3	3

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Draw flowcharts for fundamental algorithms.	CO1
II	C Programs to demonstrate C-tokens.	CO2
III	C Programs on usage of operators.	
IV	C Programs to demonstrate Decision making and branching (Selection)	
V	C programs to demonstrate different loops.	CO3
VI	C programs to demonstrate 1-D arrays.	
VII	C programs to demonstrate multi-dimensional arrays.	
VIII	C programs to perform operations on strings with String handling functions and without String handling functions.	
IX	C programs to demonstrate functions.	CO4
X	C programs on pointers.	
XI	C programs on structures and unions.	CO5
XII	C programs to demonstrate files.	

Learning Resources
Text Books
1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006. 2. Reema Thareja , Programming in C, Oxford University Press, AICTE Edition, 2018.
Reference Books
1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007. 2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition, 3. B. Gottfried, Programming with C, 3/e, Schaum‟s outlines, McGraw Hill (India), 2017. 4.Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e-Resources & other digital material
1. http://cprogramminglanguage.net/ 2. https://www.geeksforgeeks.org/c-programming- language/ 3. https://nptel.ac.in/courses/106105085/4

Basic Workshop

Course Code	19ES1153	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply wood working skills in real world applications
CO2	Build different parts with metal sheets in real world applications.
CO3	Apply fitting operations in various applications.
CO4	Apply different types of basic electric circuit connections and demonstrate soldering.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					1			3		1			
CO2	3					1			3		1			
CO3	3					1			3		1			
CO4	3					1			3					

Syllabus		
Job Type	**Contents**	**Mapped CO**
Wood Working	Familiarity with different types of woods and tools used in wood working and make following joints i) Half – Lap joint. ii) Mortise and Tenon joint. iii) Corner Dovetail joint or Bridle joint.	CO1
Sheet Metal Working	Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets i) Tapered tray ii) Conical funnel ii) Elbow pipe	CO2
Fitting	Familiarity with different types of tools used in fitting and do the following fitting exercises i) V-fit ii) Semi-circular fit iii) Bicycle tire puncture and change of two wheeler tire	CO3
Electrical	Familiarities with different types of basic electrical circuits and make the following connections	CO4

Wiring	i) Preparation of a circuit for Parallel and series connection. ii) Preparation of a circuit Go down lighting using Two way switch and tube light. iii) Soldering of wires	

Learning Resources
Text Books
1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers. 2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition

COMMUNICATIVE ENGLISH - II

Course Code	19HS1201	Year	I	Semester	II
Course Category	Humanities	Branch	CSE	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	Basic knowledge of grammar and fundamental concepts of Reading and Writing
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Demonstrate good writing skills for effective paraphrasing and synthesizing information
CO2	Analyze facts from opinions while reading and writing formal letters and e mails using a range of vocabulary in formal writing
CO3	Evaluate reading texts and learn good writing skills for effective argumentative essays and formal correspondence.
CO4	Understand the structure of project reports applying grammatically correct structures and knowledge of grammar
CO5	Develop advanced reading skills for deeper understanding of texts and employability skills.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		3		1
CO2										3		3		1
CO3										3		3		1
CO4										3		3		1
CO5										3		3		1

SYLLABUS		
UNIT NO.	CONTENT	Mapped CO
I	**Reading:** Reading for presenting - strategies to select, compile and synthesize information for presentation-Comprehending a wide range of texts -Reading to recognize academic style **Reading for Writing:** Paraphrasing - using quotations and in-text references; using academic style - avoiding colloquial words and phrases - Writing an essay after researching a topic - Citing the sources used **Grammar and Vocabulary:** Academic verbs in context; formal words and	CO1

	phrases-Awareness about Root words	
II	**Reading:** Recognizing formal and informal styles -Recognizing the difference between facts and opinions - Identifying and understanding different perspectives **Writing:** Letter writing and e mail writing - Structure, Conventions and Etiquette – Informal, semi- formal and formal (enquiry, complaints, seeking permission, seeking internship - Re-draft a piece of text from a different perspective - Writing brief critical reviews of short texts **Grammar and Vocabulary:** Agreement: Subject-verb, Noun-pronoun; Editing short texts - Phrasal verbs - Phrasal prepositions - Avoiding clichés	CO2
III	**Reading:** Identifying claims, evidences, views/opinions, purpose, and stance/position -Understand the correlation between a talk and a reading text based on inferences made. **Writing:** Writing structured analytical and argumentative essays on general topics using suitable claims and evidences with the sources cited-Peer review of the essays written **Grammar and Vocabulary:** Language for different functions such as stating a point, expressing opinion, Agreeing/disagreeing, Adding information to what someone has stated, and asking for clarification - Modifiers and misplaced modifiers	CO3
IV	**Reading:** Reading varied text types - Structure and contents of a formal report -Sections in a report and understanding the purpose of each section- Significance of references **Writing:** Writing reports **Grammar and Vocabulary:** Active and passive voice - Use of passive verbs in academic writing	CO4
V	**Reading:** Reading for inferential comprehension **Writing:** Writing one‟s CV and cover letter - Applying for a job/internship **Grammar and Vocabulary:** Reinforcing learning - Edit one‟s writing to correct common errors in grammar and usage - Use appropriate vocabulary for speaking and writing – Various purposes	CO5

LEARNING RESOURCES

Reference Books:

1. Bailey, Stephen. *Academic writing: A handbook for international students.* Routledge, 2014.
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
3. Hewings, Martin. *Cambridge Academic English (B2).* CUP, 2012(Student Book, Teacher Resource Book, CD & DVD)

e- Resources & other digital material:

Grammar/Listening/Writing:
1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/
Grammar/Vocabulary:
English Language Learning Online; http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/; http://www.nonstopenglish.com/
https://www.vocabulary.com/; BBC Vocabulary Games

Free Rice Vocabulary Game
Reading:
https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/
All Skills:
https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/
Online Dictionaries:
Cambridge dictionary online; MacMillan dictionary; Oxford learner‟s dictionaries

Engineering Mathematics – 2 (Probability and Statistics)

Course Code	19BS1202	Year	I	Semester	II
Course Category	Basic Sciences	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	classify the concepts of data science and its importance
CO2	apply discrete and continuous probability distributions
CO3	explain the association of characteristics through correlation and regression tools
CO4	identify the components of a classical hypothesis test
CO5	infer the statistical inferential methods based on small and large sampling tests

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											1	1
CO2	3	2											1	1
CO3	3	2											1	1
CO4	3	2											1	1
CO5	3	2											1	1

Syllabus

Unit No.	Contents	Mapped CO
I	Data Science and Probability: Data Science: Statistics introduction, Population vs Sample, collection of data, primary and secondary data, types of variable: dependent and independent Categorical and Continuous variables, data visualization, Measures of central tendency, Measures of dispersion (variance). Probability: Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye‟s theorem (without proof).	CO1
II	Random Variable and Probability Distributions: Random variables (discrete and continuous), probability density functions, probability distribution - Binomial, Poisson and normal distribution-their properties (mathematical expectation and variance).	CO2
III	Correlation, Regression and Estimation: Correlation, correlation coefficient, rank correlation, regression, lines of regression, regression coefficients, principle of least squares and curve fitting (straight Line, parabola and exponential curves). Estimation: Parameter, statistic, sampling distribution, point estimation, properties of estimators, interval estimation.	CO3
IV	Testing of Hypothesis and Large Sample Tests: Formulation of null hypothesis, alternative hypothesis, the critical region,	CO4

	two types of errors, level of significance, and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems	
V	Small Sample Tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.	CO5

Learning Resources
Text Books
1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008. 2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
Reference Books
1 S. Ross, A First Course in Probability, Pearson Education India, 2002. 2.W. Feller, An Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968
e-Resources & other digital material
1. www.nptel videos.com/mathematics/ 2. nptel.ac.in/courses/122104017 3. nptel.ac.in/courses/111105035

Engineering Physics Lab

Course Code	19BS1253	Year	I	Semester	II
Course Category	Basic Sciences	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Assess the intensity of the magnetic field of circular coil carrying current with varying distance and utilize four probe set up to measure resistance.
CO2	Evaluate the acceptance angle of an optical fiber and numerical aperture and loss.
CO3	Demonstrate the importance of dielectric material and measure magnetic parameters.
CO4	Identify the type of semiconductor using hall effect and determine the band gap of a semiconductor.
CO5	Understand the characteristics of photodiode, p-n junction diode and solar cell.Type equation here.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3											
CO2	3		3											
CO3	3		3											
CO4	3		3											
CO5	3		3											

Syllabus		
Expt. No.	Contents	Mapped CO
I	To Determine The Magnetic Field Along The Axis Of A Circular Coil Carrying Current	CO1
II	To Determine The Magnetic Susceptibility By Gouy‟s Method	
III	To Determine The Numerical Aperture Of A Given Optical Fibre And Hence To Find Its Acceptance Angle	CO2
IV	To Determine The Dielectric Constant Of A Substance By Resonance Method	CO3
V	To Determine The Resistivity Of Semiconductor By Four Probe Method	CO4
VI	To Determine The Hall Coefficient Using Hall Effect Experiment.	
VII	To Determine The Energy Gap Of A Semiconductor	
VIII	To Study The Characteristics Of Photo Diode	CO5
IX	To Study The Characteristics Of PN Diode	
X	To Study The Characteristics Of Solar Cell	

Learning Resources
Text Books

RamaraoSri,ChoudaryNityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010
Reference Books
Semiconductor Devices & Physics, S.M.Sze,Wiley,2008.
e-Resources & other digital material
https://www.niser.ac.in/sps/teaching-laboratories

Basic Electrical & Electronics Engineering

Course Code	19ES1201	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	CSE	Course Type	Theory
Credits	4	L-T-P	3-1-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO2	To explain the concepts of electrical machines and their characteristics.
CO3	To identify the importance of transformers in transmission and distribution of electric power.
CO4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO5	To expose basic concepts and applications of Operational Amplifier and configurations.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					1		1		2	1		1
CO2	3	2				1	1		1		2	1		
CO3	3	2				1	1		1		2	1		
CO4	3	2					1		1		2	1	1	1
CO5	3	2					1		1		2	1	1	1

Syllabus		
Unit No.	Contents	Mapped CO
I	Basic laws and Theorems: Ohms law, Kirchoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples.	CO1
II	DC Machines: Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.	CO2
III	Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. Three Phase Induction Motors: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.	CO3
IV	Semiconductor Devices: p-n Junction diode - Basic operating principle,	CO4

	current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.	
V	Operational Amplifiers: The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open- loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.	CO5

Learning Resources
Text Books
1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017. 2 B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition,S.Chand Publishing, New Delhi, 2006. 3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books
1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education,2011. **2.** Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008. **3.** R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi,2012.
e-Resources & other digital material
http://202.53.81.118/course/view.php?id=122 https://nptel.ac.in/courses/108105112/

Engineering Graphics

Course Code	19ES1203	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	CSE	Course Type	Theory
Credits	2.5	L-T-P	1-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Conic sections and curves used in engineering practice.
CO2	Orthographic projections of points, lines, planes and solids.
CO3	Isometric and orthographic views.
CO4	Development of lateral surfaces of solids.
CO5	Features of CAD packages.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3									3	1		1	
CO2	3									3	1		1	
CO3	3									3	1		1	
CO4	3									3	1		1	
CO5	3				3					3	1		1	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Engineering Graphics** : Principles of Engineering Graphics and their significance- Conventions in drawing, lettering, dimensioning, BIS conventions. a) **Conic sections**: Construction of ellipse, parabola and hyperbola (general method only) b) **Cycloidal curves**: Cycloid, Epicycloid and Hypocycloid c) **Involutes**: Involute of regular polygons and Circle.	CO1
II	**Projection of points, lines and planes:** Projection of points in different quadrants, lines inclined to one and both the reference planes, finding true length and inclination made by the line. Projections of regular plane surfaces.	CO2
III	**Projections of solids:** Projections of regular solids such as cube, prism, p cylinder and cone (Treatment limited to solids inclined to one of the referen **Sections of solids:** Section planes and sectional view of right regular solids- cube, prism, cylinder, pyramid and cone. True shape of the	CO3

	section. (Treatment limited to the solids perpendicular to one of the principal planes)	
IV	**Orthographic Views:** Systems of projections, conversion of isometric view to orthographic view. **Isometric Projections:** Principles of isometric projection- isometric scale; isometric views: lines, planes and solids. (Treatment is limited to simple objects only)	CO4
V	**Development of surfaces:** Development of lateral surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts. (Treatment limited to solids perpendicular to one of the principal planes)	CO5
	Introduction to CAD: Basic drawing, editing and dimensioning commands: line, circle, rectangle, erase, view, undo, redo, snap, edit, move, copy, rotate, scale, mirror, layer, template, polyline, trim, extend, stretch, fillet, array, dimension.	

Learning Resources

Text Books

1. N.D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.
2. K.L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, 2012.

Reference Books

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009.
3. K. Venugopal, Engineering Drawing and Graphics, 6/e, New Age Publishers, 2011.
4. K.C. John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 2008.

e-Resources & other digital material

1. http://www.youtube.com/watch?v=XCWJ XrkWco, Accessed On 01-06-2017.
2. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# isodrawing, Accessed On 01-06-2017.
3. http://www.slideshare.net, Accessed On 01-06-2017.
4. http://edpstuff.blogspot.in, Accessed On 01-06-2017.

COMMUNICATIVE ENGLISH - II LAB

Course Code	19HS1251	Year	I	Semester	II
Course Category	Humanities	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Fundamental knowledge of Listening and Speaking skills
Continuous Internal Evaluation	25	Semester End Evaluation	50	Total Marks	75

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the purpose of a presentation and learn strategies to present the text.
CO2	Comprehend talks/lectures and answer inferential questions using PPTs/audio- visual aids
CO3	Analyze the comprehensive ability and logical thinking for better listening and speaking.
CO4	Facilitate active listening to enable inferential learning through expert lectures and talks and team up with a colleague to participate well in role plays.
CO5	Develop advanced listening skills for an in-depth understanding of complex texts and collaborate with a partner for effective performance in mock interviews

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3		3	1	
CO2									2	3		3	1	
CO3									2	3		3	1	
CO4									2	3		3	1	
CO5									2	3		3	1	

SYLLABUS		
EXPERIMENT NO.	CONTENT	Mapped CO
1	Listening for presentation strategies and answering questions on the speaker, audience, and key points	CO1
2	Formal presentations using PPT slides (individual)	
3	Relating a reading text to a talk/presentation – understanding different perspectives and drawing inferences	CO2
4	Formal team presentations using PPT slides/audio- visual aids	
5	Identifying views and opinions expressed by different speakers while listening to discussions	CO3

6	Group discussion on general topics	
7	Processing of information using context clues while listening to talks/lectures	CO4
8	Role plays – people from various fields of work	
9	Processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge	CO5
10	Mock interviews for jobs/internships	

LEARNING RESOURCES

Reference Books:

1. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012(Student Book, Teacher Resource Book, CD & DVD)

e- Resources & other digital material:

Grammar/Listening/Writing:

1-language.com

http://www.5minuteenglish.com/

https://www.englishpractice.com/

Listening:

https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html

Speaking:

https://www.talkenglish.com/BBC; Learning English – Pronunciation tips

Merriam-Webster – Perfect pronunciation Exercises

All Skills:

https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/

Online Dictionaries:

Cambridge dictionary online; MacMillan dictionary; Oxford learner‟s dictionaries

Engineering Physics

Course Code	19BS1205	Year	I	Semester	II
Course Category	Basic Sciences	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply the fundamental laws of electricity and magnetism to currents and propagation of EM waves.
CO2	Identify the propagation of light and demonstrate the loss mechanisms in optical fibers.
CO3	Explain the principles of physics in dielectrics, magnetic materials and identify the mechanisms of polarization for useful engineering applications.
CO4	Classify solids and calculate carrier concentration and conductivity in semiconductors.
CO5	Demonstrate the functioning of solar cell, photodiode, and semiconductors devices for engineering applications.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												
CO2	3	3												1
CO3	3	3												1
CO4	3	3												1
CO5	3	3												1

Syllabus

Unit No.	Contents	Mapped CO
I	**Basics of Electromagnetics** Electrostatic field: Coulombs law and Gauss law, derivation of Coulombs law from Gauss law, applications of Gauss law (line charge, thin sheet of charge and solid charged sphere), Gauss law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson‟s and Laplace equations. Magneto static field: Biot–Savart law, divergence and curl of magnetic fields, Faraday‟s and Ampere‟s laws in integral and differential form, displacement current, continuity equation, Maxwell‟s equations	CO1
II	**Fiber Optics** Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V- number, fiber optic	CO2

	sensors (Temperature, displacement and force), applications.	
III	**Dielectric and Magnetic materials** Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only), frequency dependence of polarization, Lorentz (internal) field (quantitative), Clausius-Mossotti equation. Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials.	CO3
IV	**Semiconductor physics** Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n type and p type semiconductors.	CO4
V	**Semiconductor devices** Drift and diffusion currents in semiconductors, Hall effect and its applications, magnetoresistance, p- n junction layer formation and V-I characteristics, direct and ind irect band gap semiconductors, construction and working of photodiode, LED, solar cell	CO5

Learning Resources
Text Books
1. Engineering Physics, R.K.Gaur& S.L.Gupta, Dhanpatrai Publications. 2. Solid State Physics , S.O.Pillai, New Age International.
Reference Books
1. A Text Book Of Engineering Physics, M.N.Avadhanulu & P.G.Kshrisagar, S.Chand Publications 2. Semiconductor Devices & Physics, S.M.Sze,Wiley,2008. 3. Applied Physics, P.K. Palanai Swamy, Scitech Publications. 4. Engineering Physics, Dr.M.Arumugam, Anuradha Publications. 5. Introduction To Electrodynamics, David.J.Griffths, Pearson Education.
e-Resources & other digital material
http://physicsforidiots.com/physics/electromagnetism/ https://www.arcelect.com/fibercable.htm http://freevideolectures.com/Course/3048/Physics-of-Materials/36 https://www.iitk.ac.in/mse/electronic- materials-and-devices https://link.springer.com/chapter/10.1007/978-3-319-48933-9_35

Basic Electrical & Electronics Engineering Lab

Course Code	19ES1251	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO2	To explain the concepts of electrical machines and their characteristics.
CO3	To identify the importance of transformers in transmission and distribution of electric power.
CO4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO5	To expose basic concepts and applications of Operational Amplifier and configurations

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1					1		1	1		
CO2	3	2	2	1			1		1		1	1		
CO3	3	2	2	1			1		1		1	1		
CO4	3	2	2	1			1		1		1	1	1	
CO5	3	2	2	1			1		1		1	1	1	1

Syllabus

Expt. No.	Contents	Mapped CO
I	Verification of Kirchhoff,,s Laws KVL and KCL.	CO1
II	Verification of DC Superposition Theorem.	
III	Verification of Thevenin's Theorem and Norton's Theorem	
IV	Swinburne's tests on a DC shunt motor.	CO2
V	OC and SC Tests on single phase transformer.	CO3
VI	Brake Test on DC shunt motor.	CO2
VII	Current Voltage Characteristics of a p-n Junction Diode/LED	CO4
VIII	Diode Rectifier Circuits.	
IX	Voltage Regulation with Zener Diodes.	
X	Inverting and Non-inverting Amplifier Design with Op-amps	CO5

Learning Resources

Text Books

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017.
2 B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition,S.Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.

Reference Books

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education,2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi,2012.

Information Technology Workshop

Course Code	19CS3251	Year	I	Semester	II
Course Category	Program Core	Branch	CSE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Nil
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Identify the basic computing device peripherals
CO2	Gain knowledge on operating system concepts and its installations.
CO3	Gain knowledge on basics of networking and internet.
CO4	Learn productive tools like word, excel, and power point
CO5	Gain knowledge on Raptor tool and designing flow charts

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				2	3					3			3	2
CO2				2	3					3			3	2
CO3				2	3					3			3	2
CO4				2	3					3			3	2
CO5				2	3					3			3	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Task-1:** Identify various kinds of computing devices, different peripherals, ports and connecting cables and Assemble and disassemble the PC. **Task 2:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.	CO1
II	**Task-3**: Installation of MS-Windows. **Task-4:** Installation of Linux. **Task-5:** Practice on basic Linux OS commands. Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.	CO2
III	**Task-6**: Connecting to their Local Area Network and access the Internet, Configure the TCP/IP setting and accessing the websites and email. **Task-7:** Usage of search engines. Configure Plug-ins like Macromedia Flash and JRE for applets, Skype and Video Conferencing setup. **Task-8:** Awareness on threats on Internet, Install antivirus software,	CO3

	configure their personal firewall and windows update on their computer, customize their browsers to block pop-ups, block ActiveX downloads to avoid viruses and/or worms	
IV	**Task-9:** Exploring MS-Word and sample tasks. Document creation and editing text documents in your web browser using Google docs. **Task-10:** Excel orientation and sample tasks. Handle task lists, create project plans, analyze data with charts and filters using Google Sheets **Task-11**: PPT Orientation and sample tasks, project presentation- Google Slides, Manage event registrations, create quizzes; analyze responses- Google Forms, Web-based service providing detailed information about geographical regions and sites around the world. Explore the globe by entering addresses and coordinates-Google Maps and Earth.	CO4
V	**Task-12**: Basics on RAPTOR and designing flowcharts. **Task-13:** Demonstrate problem solving skills by developing algorithms to solve problems using Raptor tool.	CO5

Learning Resources
Text Books
Introduction to Computer-Peter Norton
Reference Books
Information Technology Workshop, 3rd Edition G Praveen Babu, MV Narayana BS Publications
e-Resources & other digital material
1. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf 2. https://zorinos.com/help/ 3. https://zorinos.com/help/install-zorin-os/ 4. http://www.googleguide.com/advanced_operators_reference.html 5. https://www.alexa.com/find-similar-sites 7. https://en.wikipedia.org/wiki/File_archiver . 8. https://raptor.martincarlisle.com/

Engineering Mathematics III
(Discrete Mathematical Structures)

Course Code	19BS1302	**Year**	II	**Semester**	I
Course Category	Basic Sciences	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Basic Mathematics
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of discrete mathematical structures.	**L2**
CO2	Apply the concepts of propositional/predicate logic to solve problems.	**L3**
CO3	Apply the method of characteristic roots for solving different recurrence relations.	**L3**
CO4	Apply the concepts of graph theory for solving problems.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3													

Course Content		
UNIT-1	**Mathematical Logic:** Introduction-Statements and Notations-Connectives(Negation,Conjunction,Disjunction)-Statement formulas and Truth Tables, Conditional and Bi-conditional, Well-Formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implication, Functionally Complete Sets of Connectives, Other Connectives. **Normal Forms:** Disjunctive Normal Forms (DNF), Conjunctive Normal Forms (CNF), Principal of Disjunctive Normal Forms (PDNF), Principal of Conjunctive Normal Forms (PCNF).	**CO1, CO2**
UNIT-2	**Theory of Inference for Statement Calculus:** Validity using Truth Tables-Rules of Inference – Consistency of Premises and Indirect Method Proof. **Predicate calculus:** Introduction to Predicates - Statement functions, Variable and Quantifiers- Predicate Formulas-Free and Bound Variables-Universe of Discourse.	**CO1,CO2**
UNIT-3	**Recurrence Relations**-The Method of Characteristic Roots-Solutions in Inhomogeneous Recurrence Relation.	**CO1,CO3**
UNIT-4	**Relations and Directed Graphs**-Special Properties of Binary Relations-Equivalence Relations- Ordering Relations, Lattices, and Enumerations-Operations on Relations- Paths and Closures-Directed Graphs and Adjacency Matrices	**CO1,CO4**
UNIT-5	**Graphs**- Basic Concepts- Isomorphism's and Sub graphs-Trees and Their Properties - Spanning Trees-Planar Graphs-Euler's Formula- Multi-graphs and Euler Circuits-Hamiltonian Graphs- Chromatic Numbers.	**CO1,CO4**
Learning Resources		
Text Books	1. Discrete Mathematical Structures with Applications to Computer Science , J P Trembly and R Manohar, 1988, McGraw-Hill (Unit-I,II) 2. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott. Abraham Kandel and Theodore P. Baker, Second Edition, 2017, PHI. (Unit-III,IV,V)	
Reference Books	1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Seventh Edition, 2017, McGraw-Hill.	
e-Resources & other digital material	https://www.geeksforgeeks.org/engineering-mathematics-tutorials/ https://www.tutorialspoint.com/discrete_mathematics/index.htm http://www.alas.matf.bg.ac.rs/~mi10164/Materijali/DS.pdf https://nptel.ac.in/courses/111107058/	

Life Sciences for Engineers

Course Code	19BS1303	**Year**	II	**Semester**	I
Course Category	Basic Sciences	**Branch**	CSE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Apply principles of biology to create tangible and economically viable engineering goods.	**L3**
CO2	Employ knowledge and expertise bio-engineering field.	**L2**
CO3	Improve the living standards of societies.	**L3**
CO4	Gain knowledge in genetic engineering.	**L1**
CO5	Implement the knowledge in genetic engineering in industrial field.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							

Course Content		
UNIT-1	**Introduction to Biology:** Comparison of Biological organisms with manmade systems- eye and camera, flying bird and aircraft. Classification of living organisms- Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources.	**CO1, CO3, CO5**
UNIT-2	**Bio-molecules:** Structure and functions of proteins and nucleic acids, hemoglobin, antibodies. Enzymes-Industrial applications , Fermentation and its industrial applications.	**CO1, CO2**
UNIT-3	**Bioenergetics and Respiration:** Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis. Human physiology.	**CO2, CO3**
UNIT-4	**Genetic Engineering:** Mendel's laws, gene mapping, Mitosis and Meiosis, Epistasis, single gene disorders in humans. Genetic code.	**CO2, CO4, CO5**
UNIT-5	**Recombinant DNA Technology:** Recombinant vaccines, transgenic microbes, plants and animals. Animal cloning, biosensors, biochips.	**CO1, CO4, CO5**
Learning Resources		
Text Books	1. Biology: A global approach, N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Tenth Edition, 2015, Pearson. 2. Biology for Engineers, Arthur T Johnson, 2011, CRC press.	
Reference Books	1. The molecular biology of the cell, Alberts et al., Sixth Edition, 2014, Garland Science. 2. Outlines of Biochemistry, E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, Fifth Edition, 2009, John Wiley and Sons. 3. Introduction to Biomedical Engineering, John Enderle and Joseph Bronzino, Third Edition, 2012, Academic Press.	

Design Thinking

Course code	19ES1302	Year	II	Semester	I
Course category	ES	Branch	CSE	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	---
Continuous Internal evaluation	30	Semester End Evaluation	70	Total marks	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Explain the principles of design thinking and its approaches.	L2
CO2	Identify the empathy, define phases in human centered design problems.	L3
CO3	Develop an idea, build a prototype and test in design thinking context.	L3
CO4	Apply design thinking techniques for product innovation.	L3
CO5	Implement design thinking in business process models.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3									1	2	2
CO2			3	2		2			2	2		1	2	2
CO3			3	2		2			3	2		1	2	2
CO4			3	2		2			2	2		1	2	2
CO5			3	2		2			2	2	1	1	2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**INTRODUCTION TO DESIGN THINKING:** An insight into Design, origin of Design thinking, Design thinking Vs Engineering thinking, importance of Design thinking, Design Vs Designthinking, understanding Design thinking and its process models, application of Design thinking	**CO1**
II	**EMPATHIZE INDESIGN THINKING:** Human-Centered Design (HCD) process - Empathize, Define, Ideate,Prototype and Test and Iterate. Role of Empathy in design thinking, methods and tools of empathy, understanding empathy tools. Explore define phase state users' needs and problems using empathy methods	**CO2**
III	**IDEATION, PROTOTYPING AND TESTING :** Ideation methods, brain storming, advantages of brain storming, methods and tools of ideations, prototyping and methods of prototyping, user testing methods, Advantages and disadvantages ofuser Testing/ Validation	**CO3**
IV	**PRODUCT INNOVATION:** Design thinking for strategic innovation , Definition of innovation, art of innovation, teams for innovation, materials and innovation in materials, definition of product and its classification. Innovation towardsproduct design Case studies	**CO4**
V	**DESIGN THINKING INBUSINESS PROCESSES:** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.	**CO5**

Learning Resources

Text Books:

1. Change by design, Tim Brown, 2009, Harper Collins.
2. Engineering design, George E Dieter,4th Revised edition, 2009 McGraw Hill.

Reference Books

1. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.
2. Design Thinking-The Guide Book – Facilitated by the Royal Civil serviceCommission, Bhutan
3. Design Methods: A Structured Approach for Driving Innovation in YourOrganization, Vijay Kumar, First Edition, 2012, Wiley.
4. Human-Centered Design Toolkit: An Open-Source Toolkit to Inspire New Solutionsin the Developing World, IDEO, Second Edition, 2011, IDEO.

e-Resources & other digital material

1. https://www.interaction-design.ora/literature/topics/design-thinking
2. https://www.interaction-design.prg/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

Fundamentals of Digital Logic Design

Course Code	19CS3301	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Basic number System, Basic Electrical & Electronics Engg. (19ES1201)
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of digital circuits.	**L2**
CO2	Apply minimization techniques to simplify Boolean expressions.	**L3**
CO3	Apply the principles of digital electronics to design combinational and sequential circuits.	**L3**
CO4	Analyze the functionality of combinational circuits.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	2													
CO3	3												3	
CO4		3							3	3				

Course Content		
UNIT-1	**Digital Systems and Binary Numbers:** Decimal, Octal, Hexadecimal number systems, Conversions, Complements, Binary codes, Arithmetic with signed and unsigned numbers (addition, subtraction), Logic Gates.	**CO1**
UNIT-2	**Boolean Algebra:** Introduction, Axioms and Laws of Boolean Algebra, Boolean functions, Minterms (SOP) and Maxterms (POS), Canonical and Standard Forms **Gate–Level Minimization**: Introduction, Two, Three, Four Variable K-map's, Don't Care Conditions, NAND and NOR implementation.	**CO1,CO2**
UNIT-3	**Combinational Logic:** Introduction to combinational logic circuits, Binary adder and subtractor, Look Ahead Carry Adder, Decoders, Encoders, Multiplexers, Demultiplexers.	**CO1,CO3,CO4**
UNIT-4	**Sequential Logic:** Introduction to sequential circuits, Latch–Flip Flop–SR, JK, T, D Flip Flops–Flip Flop excitation tables.	**CO1,CO3**
UNIT-5	**Registers and Counters:** Registers, Shift registers, Synchronous and Asynchronous (ripple) counters, BCD counter (synchronous and asynchronous), Ring counter, Johnson counter.	**CO1,CO3**
Learning Resources		
Text Books	1. Digital Design, M. Morris Mano, Michael D.Ciletti, Fifth Edition, 2013, Pearson.	
Reference Books	1. Switching Theory and Finite Automata, Zvi. Kohavi, Niraj K. Jha, Third Edition, 2010, Cambridge University Press. 2. Fundamentals of Digital circuits, A. Anand Kumar, Third Edition, 2013, PHI.	
e-Resources & other digital material	1. https://nptel.ac.in/courses/106/108/106108099/ 2. http://nptel.ac.in/courses/117106086/1 3. https://nptel.ac.in/courses/117/105/117105080/ 4. https://www.udemy.com/course/digital-electronics-logic-design/ 5. https://learnabout-electronics.org/Digital/dig20.php 6. https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm 7. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/	

Object Oriented Programming

Course Code	19CS3302	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Problem solving and Programming (19ES1102)
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of Object Oriented Programming & constructs of Java programming language	**L2**
CO2	Apply object oriented programming principles for solving problems	**L3**
CO3	Apply type hierarchy in collection framework of Java	**L3**
CO4	Analyze the suitable group of generic classes and implementations to solve problems on online platforms	**L4**
CO5	Analyze proper exception handling mechanism to avoid abnormal termination of program	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3													
CO4		3			3				3	3				
CO5		3												

Course Content		
UNIT-1	**Fundamentals of OOP and Java** **Java Basics** -Need of OOP, Procedural Languages vs. OOP, Principles of OOP Languages, Java Virtual Machine, Java Features. **Java Programming constructs-** Variables, Data types, Identifiers, Keywords, Operators, Control Statements, Arrays. **String Handling-** String Class, StringBuffer Class and StringTokenizer Class.	**CO1, CO2**
UNIT-2	**Class Fundamentals and Inheritance** **A Closer Look at Methods and Classes-** Class Fundamentals, Declaring Objects, Methods, Constructors, Static Keyword, this keyword, Overloading methods and constructors. **Inheritance-** Basics, Types of Inheritance, Member access rules, Implementation of Inheritance. **Polymorphism-** Overloading, Method overriding, using super keyword, Dynamic Method Dispatch, Abstract Classes, Final Keyword.	**CO1, CO2**
UNIT-3	**Interfaces and Packages** **Interfaces-** Differences between Classes and Interfaces, Defining an Interface, Implementing Interfaces, variables in interfaces and extending interfaces. **Packages-** Defining, Creating and Accessing a Package, Access Controls, Object class, Wrapper Classes.	**CO1,CO2,CO5**
UNIT-4	**Exception Handling and Multithreading** **Exception Handling-** Exception Handling Fundamentals, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, User-defined exceptions **Multithreading -** Introduction to Multitasking, Thread Life Cycle, Creating Threads, Synchronizing threads.	**CO1,CO2,CO4**
UNIT-5	**The Collection Framework** **Collection Framework-** Need for Collection Framework, Hierarchy of Collection Framework, Array List, Importance of methods like Hashcode() and equals(). **Collection objects-** sets, lists, stacks, queues, maps.	**CO1, CO2,CO3**
Learning Resources		
Text Books	1. Java - The Complete Reference, Herbert Schildt, Ninth Edition, 2014, McGraw -Hill.	
Reference Books	1. Programming in Java, Sachin Malhotra, Saurabh Choudhary, Second Edition, 2018, Oxford. 2. Head First Java, Bert Bates, Kathy Sierra, Second Edition, 2005, O'Reilly. 3. Core Java an Integrated Approach, Dr. R. Nageswara Rao, 2017, Dreamtech. 4. Object Oriented Programming through Java, P. Radha Krishna, 2007, Universities Press.	
e- Resources & other digital material	1. https://nptel.ac.in/courses/106/105/106105191/ 2. https://www.udemy.com/course/java-tutorial/ 3. https://www.decodejava.com/ 4. https://www.codecademy.com/learn/learn-java 5. https://www.w3schools.com/java/	

Data Communication

Course Code	19CS3303	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Basic Electrical & Electronics Engineering (19ES1201)
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of data communications and networking.	**L2**
CO2	Apply suitable conversion/transmission techniques on data and signals.	**L3**
CO3	Apply suitable transmission media/switching techniques for a given context.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3								3	3				
CO3	3													

Course Content		
UNIT-1	**Introduction: -** Data Communications, Networks, Network Types. **Network Models :-**The Protocol Layering , TCP/IP Protocol Suite, The OSI Model	**CO1**
UNIT-2	**Introduction to Physical Layer:-** Data & Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance.	**CO1,CO2**
UNIT-3	**Digital Transmission :-** Digital to Digital Conversion: - Line coding and line coding schemes (unipolar, polar), Block coding. Analog to Digital Conversion: - Pulse Code Modulation, Delta Modulation. Transmission Modes: - Parallel Transmission, serial Transmission. **Analog Transmission :-** Analog to Analog conversion :- Amplitude Modulation, Frequency Modulation, Phasemodulation, Multiplexing (Brief Introduction):- FDM, WDM, STDM.	**CO1,CO2**
UNIT-4	**Transmission media :-** Introduction, Guided Media:-Twisted pair cable, Co-axial cable, Fiber optic cable, Unguided media: - Wireless-Radio waves, Microwaves, Infrared**.**	**CO1,CO3**
UNIT-5	**Switching :-** Introduction, Circuit switched networks, Packet Switching, Structure of a Switch	**CO1,CO3**
Learning Resources		
Text Books	1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, 2017, McGraw Hill.	
Reference books	1. Data and Computer Communication, William Stallings, Tenth Edition, 2014, Pearson.	
e-Resources & other digital material	1. https://nptel.ac.in/courses/106/105/106105082/ 2. http://nptel.ac.in/courses/106106091/1 3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/lecture-notes/	

Data Structures

Course Code	19CS3304	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Problem solving and Programming (19ES1102)
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basic concepts of algorithm complexities, Recursion and data structures.	**L2**
CO2	Apply suitable searching, sorting algorithms for various applications.	**L3**
CO3	Apply appropriate linear data structures to solve problems.	**L3**
CO4	Apply appropriate non-linear data structures to solve problems.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				3
CO4	3													3

Course Content		
UNIT-1	**Introduction:** Algorithm Specification, Time complexity & space complexity and their notations. **Recursion:** What is Recursion, Why Recursion, Format of a Recursive function, Recursion and memory, Recursion Vs Iteration, Examples. **Sorting and Searching:** Searching- Linear and Binary search algorithms, Sorting- Bubble, Insertion, Selection, Merge, Quick sort algorithms.	**CO1, CO2**
UNIT-2	**Linked lists:** Single linked list, double linked list, circular linked list, and operations on linked lists.	**CO1, CO3**
UNIT-3	**Stacks:** Definition, operations: array implementation, linked list implementation and applications. **Queues:** Definition, operations: array implementation, linked list implementation and applications, Circular Queue.	**CO1, CO3**
UNIT-4	**Trees:** Introduction- Terminology, representation of trees, binary trees abstract data type, Properties of binary trees, binary tree representation, binary tree traversals In order, preorder, post order, Binary search trees Definition, searching BST, insert into BST, delete from a BST, Height of a BST.	**CO1, CO4**
UNIT-5	**Graphs:** The Graph ADT Introduction, definition, graph representation, elementary graph operations BFS, DFS, Minimum Spanning Tree.	**CO1, CO4**
Learning Resources		
Text Books	1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, 2002, Pearson. 2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Third Edition, 2010, PHI. 3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, 2020, CareerMonk Publications.	
Reference Books	1. Fundamental of Data Structures in C, Horowitz, Sahani, Anderson-Freed, Second Edition, 2008, Universities Press. 2. Classic Data Structures, Debasis Samantha, Second Edition, 2009, PHI.	
e- Resources & other digital material	1. http://cse.iitkgp.ac.in/pds/ 2.http://cmpe.emu.edu.tr/bayram/courses/231/LectureNotesSlides/IQBAL/Lecture%20Notes 3. https://www.geeksforgeeks.org/data-structures/ 4. https://www.programiz.com/dsa 5. https://www.tutorialspoint.com/data_structures_algorithms/index.htm 6. https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F 7.https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLgj_V-KxRKrxgFyOutPJpoLFBaQMOpK-	

Environmental Sciences

Course Code	19MC1301	**Year**	II	**Semester**	I
Course Category	Mandatory Course	**Branch**	CSE	**Course Type**	Theory
Credits	0	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	100	**Semester End Evaluation:**	-	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Develop an awareness and knowledge on natural resource protection.	**L3**
CO2	Compile for the better future of environment in India which is based on many positive factors like Biodiversity and ecosystems.	**L3**
CO3	Apply knowledge how to manage the harmful pollutants.	**L3**
CO4	Identify solutions for global environmental problems for sustainable environment.	**L3**
CO5	Create awareness among the youth on environmental acts; take part in Environment impact assessment and management plans.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3													3

Course Content		
UNIT-1	**Introduction To Environment And Natural Resources** Introduction to environment: Definition scope importance need for public awareness. Natural resources: Renewable and non-renewable resources, natural resources and associated problems. Forest resources: Uses, Reasons for over-exploitation, deforestation effects case studies. Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: Uses, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Impacts of overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, use of renewable and non-renewable energy sources, case studies.	**CO1**
UNIT-2	**Ecosystems And Biodiversity** Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem, Ecological succession. Biogeochemical cycle: Nitrogen, carbon, Phosphorus cycle. Biodiversity: Definition, Levels of biodiversity: genetic, species and ecosystem diversity. Bio-geographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In– situ and Ex-situ conservation of biodiversity.	**CO2**
UNIT-3	**Environmental Pollution And Control** Environmental Pollution: Definition, causes, effects and control measures: Air Pollution, Water pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards, Solid waste Management, e-waste, Pollution case studies.	**CO3**
UNIT-4	**Social Issues AndGlobal Environment Problems And Efforts** From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management, and Remote sensing and GIS methods. Environmental ethics: Issues and possible solutions. Green building concept, Environmental Impact Assessment Environmental Management Plan, Climate change: global warming, acid rain, ozone layer depletion.	**CO4**
UNIT-5	**Human Population And Environment Legislation** Population growth, Environment and human health. HIV/AIDS,. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act.	**CO5**
Learning Resources		
Text Books	1. Environmental studies, Anubha Kaushik and C.P. Kaushik, 2014, New Age International Publishers. 2. Text book of environmental studies for undergraduates courses, Erach Barucha, University Grants Commission, 2005, University Press. 3. Environmental Studies, Anindita Basak, 2009, Pearson.	
Reference Books	1. A Text book of Environmental Studies, D.K. Asthana and Meera Asthana, 2010, S. Chand. 2. Solid and Hazardous waste Management, P.M Cherry, 2016, CBS Publisher. 3. Environmental Impact Assessment, Charles H. Ecclestion, 2011, CRC Press.	

Life Sciences for Engineers Lab

Course Code	19BS1351	**Year**	II	**Semester**	I
Course Category	Basic Sciences	**Branch**	CSE	**Course Type**	Practical
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Apply principles of biology to create tangible and economically viable engineering goods.	**L3**
CO2	Employ knowledge and expertise bio-engineering field.	**L2**
CO3	Improve the living standards of societies.	**L3**
CO4	Gain knowledge in genetic engineering.	**L1**
CO5	Implement the knowledge in genetic engineering in industrial field.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							

Course Content		
Expt.No.1	Microscopy	**CO1, CO3**
Expt.No.2	Dissect & mount different parts of plants using Microscope	**CO1, CO3**
Expt.No.3	Estimation of Proteins by using Biuret method	**CO1, CO2**
Expt.No.4	Estimation of enzyme activity.	**CO1, CO2**
Expt.No.5	Estimation of chlorophyll content in some selected plants.	**CO1, CO3**
Expt.No.6	Nitrogen Cycle: Estimation of Nitrates /Nitrites in soil by using Spectrophotometer	**CO2, CO3**
Expt.No.7	Mendal's laws	**CO1, CO4**
Expt.No.8	Solve Problems based on Mapping.	**CO2, CO4**
Learning Resources		
Text Books	1. Biology: A global approach, N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Tenth Edition, 2015, Pearson. 2. Biology for Engineers, Arthur T Johnson, 2011, CRC press.	

Design Thinking Lab

Course code	19ES1352	Year	II	Semester	I
Course category	Engineering sciences	Branch	CSE	Course Type	Lab
Credits	2	L-T-P	0-0-2	Prerequisites	-
Continuous Internal evaluation	25	Semester End Evaluation	50	Total marks	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Develop a mind maps for design thinking process	L3
CO2	Prepare empathy maps and journey maps for problems.	L3
CO3	Construct mock-up models through ideation and innovation techniques	L5
CO4	Use software for design thinking problems	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO 1			2	2					3				2	2
CO 2			2	2					3				2	2
CO 3			2	2					3				2	2
CO 4			2	2					3				2	2
CO 5			2	2					3				2	2

Syllabus		
Exp No	**List of Experiments**	**Mapped CO**
1	Design a mind map of design thinking	**CO1**
2	Thirty circle Exercise ---ideation	**CO3**
3	Prepare a toothpick bridge (mock-up model)	**CO1,CO3**
4	Prepare a marble maze (mock up model)	**CO1,CO3**
5	Build a wind power car (mock up model)	**CO1,CO3**
6	Make a hydraulic elevator (mock up models)	**CO1,CO3**
7	Construct Empathy maps for a given case study-1	**CO2**
8	Develop customer journey map for a given casestudy-1	**CO2**
9	Construct Empathy maps for a given case study-2	**CO2**
10	Develop customer journey map for a given case study -2	**CO2**
11	Make a paper prototype for user testing (mock-up model)	**CO2**
12	Design and development of cell phone wallet (mock-upmodel)	**CO1,CO2,CO3**
13	Design thinking casestudy-1using sprint base software	**CO4**
14	Design thinking casestudy-2using sprint base software	**CO4**

Learning Resources
Text Books:
1. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).
2. "Change by design", Tim Brown, Harper Collins, 2009
"Design Thinking- The Guide Book" – Facilitated by the Royal Civil serviceCommission, Bhutan
4. Engineering design by George E Dieter
REFERENCE BOOKS
1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar
2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO
ADDITIONAL LEARNING RESOURCES
https://www.interaction-design.ora/literature/topics/design-th/nking
https://www.interaction-design.prg/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

Object Oriented Programming through Java Lab

Course Code	19CS3351	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Problem solving and Programming
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply object oriented principles/ Java constructs for solving problems	**L3**
CO2	Implement programs as an individual on different IDE/ online platforms.	**L3**
CO3	Develop an effective report based on various programs implemented.	**L3**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs using given constraints/test cases.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	2	2
CO2	3													
CO3	3								3	3				
CO4	3													
CO5		3												

Contents		
Expt.No.1	Implement the concept of classes and objects.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.2	Use String and String Tokenizer classes to develop Java programs.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.3	Implement reusability concept through inheritance.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.4	Implement concept of Polymorphism.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.5	Develop Java programs using Abstract Class.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.6	Use interfaces to develop Java programs.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.7	Create a package and access members from a package.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.8	Implement Exception handling to build robust programs.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.9	Develop Java programs using Multithreading.	**CO1,CO2,CO3,CO4,CO5**
Expt.No.10	Implement various data structures using Collection Framework.	**CO1,CO2,CO3,CO4,CO5**
Case Study:	Apply object oriented concepts to build an application.	

Learning Resources	
Text Books	Java - The Complete Reference, Herbert Schildt, Ninth Edition, 2014, McGraw-Hill.
Reference Books	5. Programming in Java, Sachin Malhotra, Saurabh Choudhary, Second Edition, 2018, Oxford. 6. Head First Java, Bert Bates, Kathy Sierra, Second Edition, 2005, O'Reilly. 7. Core Java an Integrated Approach, Dr. R. Nageswara Rao, 2017, Dreamtech. Object Oriented Programming through Java, P. Radha Krishna, 2007, Universities Press
e-Resources & other digital material	1. http://www.learnjavaonline.org/ 2. http://vtc.internshala.com/signup/course_details2.php?course=java101 3. https://nptel.ac.in/courses/106/105/106105191/ 4. https://www.udemy.com/course/java-tutorial/ 5. https://www.decodejava.com/ 6. https://www.codecademy.com/learn/learn-java 7. https://www.w3schools.com/java/

Data Structures Lab

Course Code	19CS3352	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1.5	**L-T-P**	0-0-2	**Prerequisites**	Problem solving and Programming
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Apply different design techniques for solving problems.	**L3**
CO2	Implement programs as an individual on different IDEs/ online platforms.	**L3**
CO3	Develop an effective report based on various programs implemented.	**L3**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs using given constraints/test cases.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	2	2
CO2					3				3					
CO3										3				
CO4	3									3				
		3												

Course Content		
Expt.No.1	Demonstrate recursive algorithms with examples.	**CO1**
Expt.No.2	Implement various searching techniques.	**CO2**
Expt.No.3	Develop programs for different sorting techniques	**CO2**
Expt.No.4	Implement and perform different operations on Single, Double and Circular Linked Lists.	**CO3**
Expt.No.5	Develop a program to perform operations of a Stack using arrays and linked Lists.	**CO3**
Expt.No.6	Develop programs to implement Stack applications.	**CO3**
Expt.No.7	Develop a program to perform operations of Linear Queue using arrays and linked Lists.	**CO3**
Expt.No.8	Implement Circular Queues.	**CO3**
Expt.No.9	Develop a program to represent a tree data structure.	**CO4**
Expt.No.10	Develop a program to demonstrate operations on Binary Search Tree.	**CO4**
Expt.No.11	Demonstrate Graph Traversal Techniques.	**CO4**
Expt.No.12	Develop a program to find Minimum cost Spanning tree.	**CO4**

Learning Resources	
Text Books	1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, 2002, Pearson. 2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third Edition, 2010, PHI. 3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, 2020, CareerMonk Publications.
Reference Books	
e- Resources & other digital material	1. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html 2. http://www.algomation.com/algorithm/single-linked-list-insert-delete 3.http://www.algomation.com/algorithm/binary-tree-insert-delete-display 4. https://www.youtube.com/watch?v=AfYqN3fGapc 5. https://www.youtube.com/watch?v=7vw2iIdqHlM 6. http://littlesvr.ca/dsa-html5-animations/sorting.php

Engineering Mathematics - IV
(Number Theory and Cryptography)

Course Code	19BS1403	**Year**	II	**Semester**	II
Course Category	Basic Sciences	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Mathematics, Algebra
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of number theory and cryptography	**L2**
CO2	Apply substitution/transposition techniques to design classical encryption c iphers	**L3**
CO3	Apply appropriate cryptographic algorithm for a given scenario and make an effective report	**L3**
CO4	Apply cryptographic hash functions for message authentication.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3													

Course Content		
UNIT-1	**Basic Concepts in Number Theory:** Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular arithmetic, Prime numbers, Fermat's Theorem and Euler's Theorems (without proofs), Testing for Primality, The Chinese Remainder Theorem (without proofs), Discrete Logarithms.	**CO1**
UNIT-2	**Classical Encryption Techniques :** Symmetric Cipher Model, Substitution Techniques-Caesar Cipher, Monoalphabetic Cipher: Playfair, Hill Ciphers, Polyalphabetic Ciphers, Onetime Pad, Transposition Techniques.	**CO1,CO2**
UNIT-3	**Block Ciphers:** Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard, Block Cipher modes of operations.	**CO1,CO3**
UNIT-4	**Public Key Cryptography**: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange- The Algorithm, Key Exchange Protocols, Man-in-the-Middle Attack.	**CO1,CO3**
UNIT-5	**Cryptographic Hash Functions**: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Message Authentication Requirements, Message Authentication Functions, MACs based on Hash functions: HMAC	**CO1,CO4**

Learning Resources

Text books

1. Cryptography and Network Security- Principles and Practice, William Stallings, Sixth Edition, 2014, Pearson.

References

1. An Introduction to the Theory of Numbers, Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery, Fifth Edition, 2008, Wiley.
2. Cryptography: Theory and Practice, Stinson. D, Third Edition, 2012, Chapman & Hall/CRC.

e-Resources and other Digital Material

1. https://nptel.ac.in/courses/106/105/106105162/
2. https://nptel.ac.in/courses/106/103/106103015/
3. https://nptel.ac.in/courses/106/105/106105031/https://www.coursera.org/learn/number-theory-cryptography

AI Tools

Course Code	19ES1401	**Year**	II	**Semester**	II
Course Category	Engineering Sciences	**Branch**	CSE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Calculus , Statistics, Probability, Graph Theory
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of Artificial Intelligence, Machine Learning and Deep Learning.	**L2**
CO2	Apply Machine learning concepts for real life Problems.	**L3**
CO3	Apply Deep Learning concepts to solve various problems.	**L3**
CO4	Analyze various machine learning methods to implement applications in different domains.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												2	
CO2	3					2	2						2	1
CO3	3					2	2						2	1
CO4		3				1	1		2				2	1

Course Content		
UNIT-1	Introduction to Artificial Intelligence: What is AI, Foundations of AI, Goals of AI, and Applications of AI.	**CO1**
UNIT-2	Machine Learning: Definition, Learning Methods: Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.	**CO1,CO2**
UNIT-3	Machine Learning Applications: Computer vision, Speech Recognition, Natural Language Processing,Decision Making process.	**CO1,CO2, CO4**
UNIT-4	Deep Learning: Basics of Deep Learning, Machine Learning vs Deep Learning, Fundamental Deep Learning Algorithm-Convolution Neural Network (CNN).	**CO1,CO3**
UNIT-5	Deep Learning Applications: Computer vision, Speech Recognition, Natural Language Processing, Decision Making process.	**CO1,CO3**

Learning Resources

Text Books

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Norvig, Third Edition, 2015, Pearson Education. (Unit-1)
2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2012, MIT Press (Unit-2&3)
3. Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow , Yoshua Bengio, Aaron Courville, Francis Bach, 2017, MIT Press. (Unit-4&5)

e-Resources & other digital material

https://swayam.gov.in/nd1_noc19_cs52/preview
https://swayam.gov.in/nd1_noc19_cs85/preview
https://emerj.com/ai-sector-overviews/machine-learning-healthcare-applications/

Computer Organization and Architecture

Course Code	19CS3401	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Fundamentals of Digital Logic Design (19CS3301)
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basic functional units of a computer system and its organization.	**L2**
CO2	Apply appropriate instructions for processing various types of computer operations.	**L3**
CO3	Applying various types of organizations on registers.	**L3**
CO4	Analyze memory hierarchy, I/O communication and pipelining.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4		3												

Course Content		
UNIT-1	**Register Transfer and Micro-Operations:** Register Transfer Language, Register Transfer, memory Transfers, Bus construction with Multiplexers, Arithmetic Micro-operations, Logic Micro-Operations, Shift Micro-operations, Arithmetic Logic Shift Unit.	**CO1,CO2**
UNIT-2	**Basic Computer Organization**: Instruction codes, Computer Registers, Computer Instructions, Timing and Control, InstructionCycle, Memory-Reference Instructions, Input- Output and Interrupt.	**CO1, CO2**
UNIT-3	**Central Processing Unit**: General registers Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control.	**CO1,CO3**
UNIT-4	**Computer Arithmetic**: Introduction, Addition and Subtraction, Booth Multiplication Algorithm. **Memory Organization**: Memory Hierarchy, Main Memory, Auxiliary memory, Associative Memory, Cache Memory, Virtual Memory.	**CO1, CO2, CO4**
UNIT-5	**Input-Output Organization**: Peripheral Devices, Input-outputInterface, Asynchronous Data Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor. **Pipeline and Parallel Processing**: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline.	**CO1,CO4**

Learning Resources

Text Books

1. Computer System Architecture, Morris M. Mano, Third Edition, 1992, Pearson.

References

1. Computer Organization and Architecture, William Stallings, Eighth Edition, 2010, PHI.
2. Computer Organization, Carl Hamachar, Vranesic, 2002, McGraw Hill.

e- Resources and other Digital Material

1. https://nptel.ac.in/courses/106/106/106106092/

Operating Systems

Course Code	19CS3402	Year	II	Semester	II
Course Category	Program Core	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Data structures, Computer Organization and Architecture
Continuous Internal Evaluation :	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the structure and functionalities of operating systems.	L2
CO2	Apply various concepts to solve problems related to process synchronization, deadlocks and make an effective report.	L3
CO3	Apply different algorithms of CPU scheduling, Page replacement and disk scheduling.	L3
CO4	Analyze process, memory and storage management strategies.	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								3	3				
CO3	3													
CO4	3													

Course Content		
UNIT-1	**Overview: Introduction**: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations **Operating System Structures:** Operating-System Services,User and Operating-System Interface,System Calls,Types of System Calls.	**CO1,CO2, CO3,CO4**
UNIT-2	**Process Management:** Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication. **Threads:** Overview, Multi-core Programming, Multithreading Models. **Process Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms (First-Come, First-Served Scheduling, Shortest-Job-First Scheduling, Priority Scheduling, Round-Robin Scheduling.)	**CO1,CO3, CO4**
UNIT-3	**Process Synchronization:** Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors. **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	**CO1, CO2**
UNIT-4	**Memory Management:** **Main Memory:** Background, Swapping, Contiguous Memory Allocation,Segmentation, Paging,Structure of the Page Table **Virtual Memory:** Background, Demand Paging, Copy-on-Write, Page Replacement, Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement, LRU-Approximation Page Replacement, Allocation of Frames, Thrashing.	**CO1, CO3,CO4**
UNIT-5	**Storage Management:** **File–System Interface:** File Concept, Access Methods, Directory and Disk Structure. **File–System Implementation:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods. **Mass-Storage Structure**: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, LOOK Scheduling, Selection of a Disk-Scheduling Algorithm.	**CO1, CO3,CO4**

Learning Resources

Text book:

1. Operating System Concepts, Abraham Silberchatz, Peter Baer Galvin, Greg Gagne, Ninth Edition, 2016, Wiley India.

References:

1. Operating Systems - Internal and Design Principles, William Stallings, Ninth Edition, 2018, Pearson.
2. Operating Systems - Harvey M.Deitel, Paul J Deitel and David R.Choffnes , Third Edition, 2019, Pearson.
3. Operating Systems - A Concept based Approach- D.M. Dhamdhere, Second Edition, 2010, McGraw Hill.

e-Resources and other Digital Material:

1. https://onlinecourses.nptel.ac.in/noc19_cs50/
2. http://www.youtube.com/watch?v=MaA0vFKtew&list=PL88oxI15Wi4Kw1aEY2bC5l_4pouojjtd4

Computer Networks

Course Code	19CS3403	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Data Communication
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basic functions and protocols of different layers	**L2**
CO2	Apply appropriate Packet switching mechanism/Addressing Formats for a given scenario	**L3**
CO3	Apply appropriate Transport & Application layer protocol for a given context.	**L3**
CO4	Analyze the given scenario and use appropriate Unicast routing algorithm	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3													

Course Content		
UNIT-1	Data-Link Layer: Introduction to Data-Link Layer - Introduction, Link-Layer Addressing. Error Detection and Correction - Introduction, Cyclic Redundancy Check. Data Link Control (DLC) - DLC Services. Media Access Control (MAC) - Random Access, Controlled Access.	**CO1, CO3**
UNIT-2	Network Layer: Introduction to Network Layer - Network-Layer Services, Packet Switching, Network-Layer Performance, IPv4 Addresses, Forwarding of IP Packets.	**CO1, CO2**
UNIT-3	Network-Layer Protocols - Internet Protocol (IP), ICMPv4. Unicast Routing - Introduction, Routing Algorithms, Unicast Routing Protocols. Next Generation IP- IPv6 Addressing, The IPv6 Protocol.	**CO1, CO2, CO4**
UNIT-4	Transport Layer: Introduction to Transport Layer-Introduction, Transport-Layer Protocols. Transport Layer Protocols-Introduction, User Datagram Protocol(UDP), Transmission Control Protocol(TCP)	**CO1, CO3**
UNIT-5	Application Layer: Standard Client-Server Protocols-World Wide Web and HTTP, FTP, Electronic Mail, Telnet, Secure Shell (SSH), Domain Name System (DNS)	**CO1, CO3**
Learning Resources		
Text Books	1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, McGraw-Hill	
Reference Books	1. Computer Networking A Top-Down Approach, James F. Kurose, Keith W. Ross, Sixth Edition, Pearson Education 2. Computer Networks, Tanenbaum Andrew S, David J. Wetherall, Fifth Edition, Pearson Education 3. Computer Networks - A Systems Approach, Larry L. Peterson, Bruce S. Davie, Fifth Edition, Morgan Kaufmann.	
e-Resources & other digital material	1. https://nptel.ac.in/courses/106/105/106105183/ 2.https://nptel.ac.in/courses/106/105/106105081/ 3.https://www.youtube.com/playlist?list=PLEAYkSg4uSQ2NMmzNNsEK5RVbhxqx0BZF	

Design and Analysis of Algorithms

Course Code	19CS3404	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Discrete mathematics, Data Structure
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental concepts of algorithm analysis and design techniques.	**L2**
CO2	Apply various algorithm design techniques for solving problems	**L3**
CO3	Analyze the performance of different algorithms in divide and conquer.	**L4**
CO4	Analyze the feasible solutions to find optimal one for the given problem.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3												2	2
CO3		3												
CO4		3							3	3			2	2

Course Content		
UNIT-1	**Introduction**: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving. **Fundamentals of the Analysis of Algorithm Efficiency:** Analysis framework and Asymptotic Notations and Basic Efficiency Classes. Introduction to Brute Force Technique, Exhaustive Search.	**CO1, CO2**
UNIT-2	**Divide and Conquer:** Introduction, Merge sort, Quick sort, Binary Search, Finding Maximum and Minimum, Strassen's Matrix Multiplication.	**CO1, CO2, CO3**
UNIT-3	**The Greedy Method:** Introduction, Huffman Trees and codes, Minimum Coin Change problem, Knapsack problem, Job sequencing with deadlines, Minimum Cost Spanning Trees, Single Source Shortest paths.	**CO1, CO2, CO4**
UNIT-4	**Dynamic Programming**: Introduction, 0/1 Knapsack problem, All pairs shortest paths, Optimal Binary search trees, Travelling salesman problem.	**CO1, CO2**
UNIT-5	**Back Tracking:** Introduction, n-Queens problem, Sum of subsets, Hamiltonian cycle. **Branch and Bound:** Introduction, Assignment problem, Travelling Salesman problem. **Introduction to Complexity classes**: P and NP Problems, NP-Complete Problems.	**CO1, CO2**
Learning Resources		
Text Books	1. Introduction to the Design & Analysis of Algorithms, Anany Levitin, Third Edition, 2011, Pearson Education. 2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2002, Pearson. 3. Algorithm Design Techniques, NarasimhaKarumanchi, CareerMonk Publications, 2018.	
Reference Books	1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third Edition, 2012, MIT Press. 2. Fundamentals of computer algorithms, Ellis Horowitz, SartajSahni, S. Rajasekharan, Second Edition, 2008, Universities Press.	
e-Resources & other digital material	1. https://nptel.ac.in/courses/106/106/106106131/ 2. https://www.cmi.ac.in/~madhavan/ 3. https://www.coursera.org/lecture/analysis-of-algorithms/resources-jMWPy 4. https://www.geeksforgeeks.org/fundamentals-of-algorithms/	

AI Tools Lab

Course Code	19ES1451	**Year**	II	**Semester**	II
Course Category	Engineering Sciences	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	-
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply various preprocessing techniques and Machine Learning/ Deep Learning methods on different datasets for a given problem.	**L3**
CO2	Implement various experiments in Jupyter Notebook Environment.	**L3**
CO3	Develop an effective report based on various learning methods implemented.	**L3**
CO4	Apply technical knowledge for a given scenario and express with an effective oral communication.	**L3**
CO5	Analyze the outputs and visualizations generated for different datasets.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2		
CO2					2				2					
CO3										2				
CO4	3													
CO5		3								1				

Course Content		
Exp No.	**Contents**	Mapped CO
1	Apply Data pre-processing techniques.	**CO1,CO2,CO3,CO4,CO5**
2	Construct a Machine Learning model using supervised learning method.	**CO1,CO2,CO3,CO4,CO5**
3	Construct a Machine Learning model using Unsupervised learning method.	**CO1,CO2,CO3,CO4,CO5**
4	Construct a Machine Learning model using Semi supervised learning method.	**CO1,CO2,CO3,CO4,CO5**
5	Develop a Deep Learning model using supervised learning method.	**CO1,CO2,CO3,CO4,CO5**
6	Develop a Deep Learning model using Unsupervised learning method.	**CO1,CO2,CO3,CO4,CO5**
7	Apply a Convolutional Neural Network for Image Classification.	**CO1,CO2,CO3,CO4,CO5**
8	Build an AI application.	**CO1,CO2,CO3,CO4,CO5**

Learning Resources

Text Books

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Norvig, Third Edition, 2015, Pearson Education.
2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2012, MIT Press
3. Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow , Yoshua Bengio, Aaron Courville, Francis Bach, 2017, MIT Press.

e-Resources & other digital material

https://github.com/atinesh-s/Coursera-Machine-Learning-Stanford
https://github.com/Kulbear/deep-learning-coursera

Computer Networks Lab

Course Code	19CS3451	Year	II	Semester	II
Course Category	Program Core	Branch	CSE	Course Type	Practical
Credits	1	L-T-P	0-0-2	Prerequisites	-
Continuous Internal Evaluation :	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic functions and protocols of different layers	L2
CO2	Apply appropriate Packet switching mechanism/Addressing Formats for a given scenario	L3
CO3	Apply appropriate Transport & Application layer protocol for a given context.	L3
CO4	Analyze the given scenario and use appropriate Unicast routing algorithm	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3												2	2

Course Content		
Expt No	**Contents**	**Mapped CO**
1.	Identify different types of Network devices/cables and Practically implement the cross-wired cable and straight through cable using crimping tool.	**CO1,CO2,CO3,CO4,CO5**
2.	Demonstrate connectivity of wired & wireless devices in Local Area Network using Hub, Switch and Router.	**CO1,CO2,CO3,CO4,CO5**
3.	Experiment with the basic network commands like Ping, IPCONFIG, and Tracert in real networks.	**CO1,CO2,CO3,CO4,CO5**
4.	Analyze Network Traffic Using Wireshark tool/ TCP dump tool	**CO1,CO2,CO3,CO4,CO5**
5.	Implement Framing Mechanism using any Programming Language.	**CO1,CO2,CO3,CO4,CO5**
6.	Implement Error Detection technique using any Programming Language.	**CO1,CO2,CO3,CO4,CO5**
7.	Experiment with configuration of Host IP, Subnet Mask and DefaultGateway of a device in LAN and establish Peer to Peer network connection.	**CO1,CO2,CO3,CO4,CO5**
8.	Demonstrate Static and Dynamic Addressing Mechanisms.	**CO1,CO2,CO3,CO4,CO5**
9.	Implement Unicast Routing Algorithm using any Programming	**CO1,CO2,CO3,CO4,CO5**
	Language.	**CO1,CO2,CO3,CO4,CO5**
10.	Demonstrate Network Address Translation (NAT)	**CO1,CO2,CO3,CO4,CO5**
11.	Show the working of Application Layer Protocols - FTP, DNS, Telnet	**CO1,CO2,CO3,CO4,CO5**
12.	Case study: Analyze, Design and build a network for an organization using Network Simulation tool.	**CO1,CO2,CO3,CO4,CO5**
Learning Resources		
Text Books		
1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, 2013, McGraw-Hill.		
e- Resources & other digital material		
https://www.youtube.com/channel/UCKXx22vOENUyHrVAADq7Z_g/videos https://www.coursera.org/learn/computer-networking https://www.udacity.com/course/computer-networking--ud436?cjevent=34367a88b5dc11ea81f900ef0a180513		

Design and Analysis of Algorithms Lab

Course Code	19CS3452	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Data Structures, Programming for Problem Solving
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply different design techniques for solving problems.	**L3**
CO2	Implement programs as an individual on different IDEs/ online platforms.	**L3**
CO3	Develop an effective report based on various programs implemented.	**L3**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs using given constraints/test cases.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	2	2
CO2	3													
CO3	3								3	3				
CO4		2												

Syllabus		
Expt No	**Contents**	**Mapped CO**
1.	Develop and implement an algorithm using Divide and Conquer strategy for a given set of problems.	**CO1,CO2,CO3,CO4,CO5**
2.	Make use of Greedy method to implement a solution for a given problem.	**CO1,CO2,CO3,CO4,CO5**
3.	Develop and implement an efficient solution using Dynamic Programming.	**CO1,CO2,CO3,CO4,CO5**
4.	Use Backtracking design technique to implement a solution for a given problem.	**CO1,CO2,CO3,CO4,CO5**
5.	Develop and implement an algorithm using Branch and Bound technique for solving a given problem.	**CO1,CO2,CO3,CO4,CO5**
6.	Case Study-1: Apply the most appropriate design technique to develop and implement an efficient solution for a given problem.	**CO1,CO2,CO3,CO4,CO5**
7.	Case Study-2: Develop and implement an optimal solution for a given problem by applying a suitable design technique.	**CO1,CO2,CO3,CO4,CO5**

Learning Resources

Text Books

4. Introduction to the Design & Analysis of Algorithms, Anany Levitin, Third Edition, 2011, Pearson Education.
5. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2002, Pearson.
6. Algorithm Design Techniques, Narasimha Karumanchi, CareerMonk Publications, 2018.

e- Resources & other digital material

https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
http://littlesvr.ca/dsa-html5-animations/sorting.php
https://www.youtube.com/watch?v=AfYqN3fGapc

Python Programming

Course Code	19CS3453	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Programming for Problem Solving
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply Python programming constructs for solving problems.	**L3**
CO2	Conduct experiments as an individual, or team member by using Python programming.	**L3**
CO3	Develop an effective report based on various programs implemented.	**L3**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs generated through Python programming.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2											2	2	2
CO2	3													
CO3	3								3	3				
CO4	3													
CO5		2												

Syllabus		
Expt No	**Contents**	**Mapped CO**
1.	Demonstrate the difference between interactive mode and IDEs	**CO1,CO2,CO3,CO4,CO5**
2.	Demonstrate programs using basic constructs of Python.	**CO1,CO2,CO3,CO4,CO5**
3.	Programs to demonstrate Programming constructs.	**CO1,CO2,CO3,CO4,CO5**
4.	Programs to demonstrate decision making and branching (Selection)	**CO1,CO2,CO3,CO4,CO5**
5.	Programs to demonstrate iterative statements.	**CO1,CO2,CO3,CO4,CO5**
6.	Build modular programs using functions.	**CO1,CO2,CO3,CO4,CO5**
7.	Programs to perform operations on strings, regular expressions with built – in functions.	**CO1,CO2,CO3,CO4,CO5**
8.	Implement programs using various data structures.	**CO1,CO2,CO3,CO4,CO5**
9.	Programs to demonstrate access specifiers.	**CO1,CO2,CO3,CO4,CO5**
10.	Programs to demonstrate types of Inheritance, polymorphism,	**CO1,CO2,CO3,CO4,CO5**
11.	Python programming to demonstrate Exception handling	**CO1,CO2,CO3,CO4,CO5**
12	Installing, importing accessing and computations on a dataset using Pandas library.	**CO1,CO2,CO3,CO4,CO5**
13	Installing, importing accessing and computations on a dataset using Numpy library.	**CO1,CO2,CO3,CO4,CO5**
14	Programs to demonstrate Files.	**CO1,CO2,CO3,CO4,CO5**
15	Installing, importing accessing and computations on a dataset using MatplotLib library	**CO1,CO2,CO3,CO4,CO5**

Learning Resources

Text Books

1. Python Programming using Problem Solving Approach, Reema Thareja, 2017, OXFORD University Press
2. Charles Severance: Python for Everybody, Exploring Data in Python 3, Creative Commons-2016
3. Jake VanderPlas: Python Data Science Handbook, Essential Tools for Working with Data, O'Reilly Media, 2016
4. Python Programming: Problem Solving, Packages and Libraries, Anurag Gupta and G.P. Biswas,2020, McGraw Hill

Reference Books

1. Core Python programming, R. NageswaraRao, 2018, Dreamtech press.
2. Programming with python, T R Padmanabhan, 2017, Springer.
3. Edouard Duchesnay: Statistics and Machine Learning in Python Release 0.2, 2018
4. Wes McKinney: Python for Data Analysis, Agile Tools for Real World Data, O'Reilly Media, 2013

e- Resources & other digital material

1. NPTEL Course: Programming, Data Structures and Algorithms using Python, Registration Link: https://nptel.ac.in/courses/106/106/106106145/
2. Coursera: Introduction to Python Programming, Registration link: https://www.coursera.org/learn/python-programming-intro

INTERNET OF THINGS

Course Code	19ES1501	Year	III	Semester	I
Course Category	ES	Branch	All Branches	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Summarize the genesis and impact of IoT applications, architectures in real world. (L2).
CO2	Illustrate diverse methods of deploying smart objects and connect them to network (L3).
CO3	Construct simple applications using Arduino. (L3).
CO4	Interpret different protocols and select which protocol can be used for a specific application (L2).
CO5	Identify and develop a solution for a given application using APIs (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
*** - Average value indicates course correlation strength with mapped PO**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	2	3	3					2	3	3
CO2	2		2	2	2	3	3					2	3	3
CO3	2	3	2	2	3	3	3					2	3	3
CO4	3	3	3	3			2					2	3	3
CO5	3	3	3	3	3	3	2	2			3	3	3	3

Syllabus		
Unit No.	Contents	Mapped CO
I	Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	CO1
II	Smart Objects: The Things in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	CO2
III	Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness	CO3

IV	Communication in the IoT: Internet Principles, Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	**CO4**
V	Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	**CO5**

Learning Resources

Text Books

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Thing Wiley Publications, 2012.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

Reference Books

1. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014
2. Srinivasa K G, Internet of Things,CENGAGE Leaning India, 2017

Software Engineering

Course Code	19CS3501	Year	III	Semester	I
Course Category	Program Core	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	
Continuous Internal Evaluation :	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamentals of Software Engineering	L2
CO2	Apply various life cycle activities for a project.	L3
CO3	Apply Risk and Quality management Strategies.	L3
CO4	Analyze and choose appropriate process Model based on User requirements.	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
CO1	3													
CO2	3								1	1			1	1
CO3	3												2	2
CO4		3				1	1							

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Software Engineering**: Software, Software Engineering, The changing nature of software, Software myths. **A Generic view of process:** Software engineering-A layered technology, a process framework, CMMI. **Process models:** The waterfall model, Incremental process models, Evolutionary process models, Unified Process Model.	**CO1,CO4**
II	**Requirements engineering:** Requirements engineering tasks, initiating the requirements engineering process, Eliciting requirements, Negotiating requirements, validating requirements. **Analysis mode l:** Requirements Analysis, Data modelling concepts, Scenario-Based Modelling, Flow-Oriented Modelling, Class-Based Modelling, Creating a behavioural model.	**CO1, CO2**
III	**Design Engineering**: Design process and Design quality, Design concepts, the design model. **Creating an architectural design**: Software architecture, Architectural styles and patterns. **Performing User interface design:** Golden rules.	**CO1, CO2**
IV	**Testing Strategies:** A strategic approach to software testing, Test strategies for conventional software- Unit testing, Integration testing, Validation testing, System testing **Testing tactics:** Software testing fundamentals, White-Box testing – Basis path testing, Control structure testing, Black-Box testing – Methods	**CO1, CO2**
V	**Risk management:** Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan. **Quality Management:** Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews	**CO1, CO3**

Learning Resources
Text Book
1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, Seventh edition, 2009, McGraw Hill, International Edition.
References
1. Software Engineering, Ian Sommerville, Seventh edition, 2004, Pearson, India 2. Software Engineering, K.K. Agarwal & Yogesh Singh, 2007, New Age International Publishers. 3. Software Engineering Principles and Practice, Waman S Jawadekar, 2004, McGrawHill. 4. Fundamentals of Software Engineering, Rajib Mall, Fourth edition, 2009, PHI.
e-Resources and other Digital Material
1. https://onlinecourses.nptel.ac.in/noc20_cs68

PROGRAM ELECTIVE-1

Advanced Data Structures

Course Code	19CS4501A	**Year**	III	**Semester**	I
Course Category	Program Elective-1	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Data Structures, Problem Solving and Programming
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the usage of various data structures such as queues, trees, Dictionaries, Graphs, Tries and their representations.	**L2**
CO2	Apply various tree operations for Balancing Trees.	**L3**
CO3	Apply the concept of Priority Queues for solving problems.	**L3**
CO4	Apply various data structures for text processing applications.	**L3**
CO5	Analyze the given scenario and choose appropriate Algorithm for solving Graph problems.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												1	
CO3	3								3	3			1	
CO4	3											1		2
CO5		3										1		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Dictionaries:** Sets, Dictionaries, Hash Tables, Open Hashing, Closed Hashing (Rehashing Methods), Hashing Functions (Division Method, Mid Square Method, Digital Folding Method), Skip Lists.	**CO1**
II	**Balanced Trees:** AVL Trees: Maximum Height of an AVL Tree, Insertions and Deletions. **2-3 Trees:** Insertion, Deletion.	**CO1,CO2**
III	**Priority Queues :** **Binary Heaps:** Insert and Delete min, Creating Heap. **Binomial Queues:** Binomial Queue Operations: Insertion and Deletion.	**CO1,CO3**
IV	**Graph algorithms :** Minimum-Cost Spanning Trees- Prim's Algorithm, Kruskal's Algorithm **Shortest Path Algorithms:** Dijkstra's Algorithm **All Pairs Shortest Paths Problem:** Warshall's Algorithm	**CO1,CO5**
V	**Pattern matching and Tries:** **Pattern matching algorithms-** the Boyer –Moore algorithm, the Knuth Morris-Pratt algorithm, Anagram Pattern Search **Tries:** Definitions and concepts of digital search tree, Binary trie, Patricia, Multi-way trie.	**CO1,CO4**

Learning Resources
Text Books
1. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Second edition , Pearson. 2. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, 2020, Career Monk Publications.
References
1. Fundamentals of DATA STRUCTURES in C, Horowitz, Sahani, Anderson-freed, Second edition, Universities Press. 2. Data Structures A Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
e-Resources and other Digital Material
1. http://lcm.csa.iisc.ernet.in/dsa/dsa.html 2. http://utubersity.com/?page_id=878 3. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures 4. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Advanced Computer Networks

Course Code	19CS4503B	**Year**	III	**Semester**	I
Course Category	Program Elective - I	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Computer Networks
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the Fundamentals of Computer Networks, performance Issues, and Technologies.	**L2**
CO2	Apply appropriate multicast routing protocol for a given context.	**L3**
CO3	Apply suitable Congestion control/Congestion Avoidance mechanism for improving QoS.	**L3**
CO4	Apply resource Allocation for a given multimedia application/overlay networks.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

COs	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3								2	2				1
CO3	3													2
CO4	3													2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Foundation:** Applications, Requirements, Network Architecture, Implementing Network Software, Performance	**CO1**
II	**Wired and Wireless Networks:** Ethernet and Multiple access networks – Physical properties, Access Protocol**,** Experience with Ethernet**. Wireless** - Wi-Fi (802.11), Bluetooth (802.15.1), Cell Phone Technologies.	**CO1**
III	**Inter-networking (Part - I): Implementation and Performance** - Switch Basics, Ports, Fabrics, Router Implementation. **The Global Internet** – Routing Areas, Inter- domain Routing (BGP), IP Version 6 (IPv6).**Multicast** – Multicast Addresses, Multicast Routing(DVMRP, PIM,MSDP),**Multiprotocol Label Switching** - Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels.	**CO1,CO2**
IV	**Inter-networking (Part - II)**:**End-to-End Protocols** - Transport for Real-Time Applications (RTP) – Requirements, RTP Design, Control Protocol. **Congestion Control and Resource Allocation** - Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control, Congestion- Avoidance Mechanisms , Quality of Service.	**CO1,CO3**
V	**Applications: Multimedia Applications** - Session Control and Call Control (SDP, SIP, H.323), Resource Allocation for Multimedia Applications, **Overlay Networks** - Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks.	**CO1,CO4**

Learning Resources

Text Books

1. Computer Networks, A Systems Approach, Larry L .Peterson, Bruce S. Davie, Fifth edition, 2012, Morgan Kaufmann publishers.

References

1. Computer Networks, Andrew S Tanenbaum and David J Wetherall, Fifth Edition, Pearson, 2012, Education.

e-Resources & Other Digital Material

1. https://cseweb.ucsd.edu/classes/wi19/cse124-a/courseoverview/compnetworks.pdf
2. https://fdocuments.in/document/solution-manual-for-computer-networks-by-larry-l-peterson-bruce-s-davie.html

Software Requirement Management

Course Code	19CS4501C	**Year**	III	**Semester**	I
Course Category	Program Elective-I	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Object Oriented Programming
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the Fundamentals of Requirement Engineering Process and estimation models	**L2**
CO2	Apply the Requirement elicitation Process in Software Development	**L3**
CO3	Apply the Requirement description and management techniques to software Development.	**L3**
CO4	Analyze various Software Estimation process models and identify the appropriate model for given software project	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3								3	3				
CO3	3												1	
CO4		3										1		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction,** requirements, requirement engineering, requirements document, best way to write requirements, detailed requirements ,difference between functional and nonfunctional requirements, system stakeholders, requirements engineering process, recognizing requirements engineering process problems, suggesting a good requirements engineering process.	**CO1**
II	**Requirements Elicitation:** Assess system feasibility, identify and consult system stakeholders, record requirement sources, system's operating environment, using business concerns to drive requirements elicitation, domain constraints, collect requirements from multiple viewpoints, use scenarios to elicit requirements, operational process.	**CO1,CO2**
III	**Describing Requirements**: Standard templates use language, use diagrams, and supplement natural language requirements, specifying requirements quantitatively. **Requirements Management:** Uniquely identify each requirement, policies for requirements management, traceability policies, maintaining a traceability manual, change management policies, identify global system requirements, identify volatile requirements, record rejected requirements.	**CO1,CO3**
IV	**Software Size Estimation**: Software estimation, size based estimation, two views of sizing, function point analysis, Mark-II FPA, full function points, LoC estimation, and conversion between size measures.	**CO1,CO4**
V	**Effort, Schedule & Cost Estimation**: estimation factors, approaches for effort and schedule estimation, COCOMO II, Putnam estimation model, algorithmic models, **Cost estimation tools:** Desirable features of requirements management tools, some requirements management tools available.	**CO1,CO4**

Learning Resources
Text Books
1. Requirements Engineering: A good practice guide, Ian Sommerville and Pete Sawyer, Seventh edition, 2005, John Wiley. 2. Software Requirements and Estimation, Rajesh Naik, Swapna Kishore, TMH, 2001.
References
1. Managing Software Requirements, A Use Case Approach, Don, Second edition, 2003, Dean, Addision Wesley. 2. Requirements Engineering and Rapid Development, Ian Graham, 1998, Addision Wesley. 3. Mastering the Requirements Process, S.Robertson, J.Robertson, Second edition, 2006, Pearson. 4. Cryptography: Theory and Practice, Stinson. D, Third Edition, 2012, Chapman & Hall/CRC.
e-Resources and other Digital Material
1. https://onlinecourses.nptel.ac.in/noc20_cs68 2. https://thedigitalprojectmanager.com

Distributed Systems

Course Code	19CS4501D	**Year**	III	**Semester**	I
Course Category	Program Elective-I	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Operating Systems
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand of the principles and foundations on which the Internet and other distributed systems are based.	**L2**
CO2	Apply different approaches for supporting distributed applications.	**L3**
CO3	Analyze the role of middleware technologies in designing Distributed systems	**L4**
CO4	Analyze the sharing of data in distributed environment using various distributed algorithms.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2:Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													2
CO3		3							3	3			1	
CO4		3												2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Characterization Of Distributed Systems:** Introduction, Examples of distributed systems, Trends in distributed systems, Focus on resource sharing, Challenges **System Models**: Introduction, Physical models, Architectural models, Fundamental models.	**CO1,CO2**
II	**Inter process Communication**: Introduction, The API for the Internet protocols, External data representation and marshalling, Multicast communication, Network virtualization: Overlay networks. **Remote Invocation**: Introduction, Request-reply protocols, Remote procedure call, Remote method invocation. **Indirect Communication**: Introduction, Group communication, Publish-subscribe systems, Message queues, Shared memory approaches.	**CO1,CO2**
III	**Operating System Support**: Introduction, The operating system layer, Protection, Processes and threads, Communication and invocation, Operating system architecture, Virtualization at the operating system level. **Distributed Objects and Components**: Introduction, Distributed objects, Case study: CORBA, From objects to components.	**CO1,CO3**
IV	**Time And Global States**: Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Distributed debugging **Coordination And Agreement:** Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems	**CO1,CO4**
V	**Distributed Transactions:** Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery **Replication:** Introduction, System model and the role of group communication, Fault-tolerant services	**CO1,CO4**

Learning Resources
Text Book
1. Distributed System: Concepts and Design, Coulouris, Dollimore, Kindberg, 2006, Pearson Education.
References
1. Distributed Operating System, Tanenbaum S, 2005, Pearson Education. 2. Distributed System: Concepts and Design, P K Sinha, 2004, PHI. 3. Advanced Concepts in Operating Systems, Mukesh Singhal & Niranjan G Shivaratri, 2001, Tata McGraw Hill.
e-Resources and other Digital Material
1. https://www.cdk5.net/wp/ 2. www.distributedsystemscourse.com 3. https://ocw.mit.edu/

Formal Languages and Automata Theory

Course Code	19CS3502	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Discrete Mathematics
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamental concepts of Formal Languages and Automata.	**L2**
CO2	Apply the knowledge of Automata Theory, Grammars & Regular Expressions for solving various problems.	**L3**
CO3	Apply different Turing machines techniques to solve problems.	**L3**
CO4	Analyze automata and their computational power to recognize languages.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3								2	2				
CO3	3													
CO4		2											1	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Automata:** Why study Automata Theory?, The central Concepts of Automata Theory. **Finite Automata:** Deterministic Finite Automata, Non-Deterministic Finite Automata, Finite Automata with Epsilon Transitions, Finite Automata with Outputs(without conversions)	**CO1, CO2, CO4**
II	**Regular Expressions and Languages**: Regular Expressions, Finite Automata and Regular Expressions, Algebraic Laws for Regular expressions (without proofs). **Properties of regular Languages:** Proving Languages not to be regular, Closure properties of Regular Languages (without proofs), Equivalence and Minimization of Automata.	**CO1, CO2**
III	**Context–free grammars and Languages**: Context–free grammars, Parse trees, Ambiguity in grammars and Languages, **Properties of Context-free languages:** Normal Forms for Context Free Grammars, The Pumping Lemma For Context Free Languages	**CO1, CO2**
IV	**Pushdown Automata:** Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA‟s and CFG‟s, Deterministic Pushdown Automaton.	**CO1, CO2, CO4**
V	**Turing Machines:** Problems that computer cannot solve, The Turing Machine, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine **Undecidability:** Recursively Enumerable Language, Universal Turing Machines (UTM), Halting Problem, Post Correspondence Problem, Church Hypothesis.	**CO1,CO2, CO3, CO4**

Learning Resources
Text Books
1. Introduction to Automata Theory, Languages and Computations, J.E.Hopcroft, R.Motwani and J.D Ullman, Third Edition, Pearson Education. 2. Theory of Computer Science, Automata languages and computation, Mishra, Chandra Shekaran, Second Edition, PHI.
Reference Books
1. Introduction of the Theory and Computation, Michael Sipser, 1997, Thomson Brokecole. 2. Elements of The theory of Computation, H.R.Lewis and C.H.Papadimitriou, Second Edition, 2003, Pearson Education/PHI. 3. Formal Languages and Automata Theory, Basavarj S. Anami, Karibasappa K.G, WILEYINDIA. 4. Introduction to Languages and the Theory of Computation, J.C.Martin, Third Edition, TMH, 2003.
e- Resources & other digital material

1. https://www.udemy.com/course/formal-languages-and-automata-theory-e/
2. https://eecs.wsu.edu/~ananth/CptS317/
3. https://nptel.ac.in/courses/106/103/106103070/
4. https://nptel.ac.in/courses/106/106/106106049/
5. https://nptel.ac.in/courses/111/103/111103016/
6. https://nptel.ac.in/courses/106/105/106105196/

Database Management Systems

Course Code	19CS3502	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Engineering Mathematics -1, Data Structures
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of database management systems	**L2**
CO2	Apply SQL as well as Relational Algebra to find solutions to a broad range of queries	**L3**
CO3	Apply various data models for database design	**L3**
CO4	Apply normalization techniques to improve database design	**L3**
CO5	Analyze a given database application scenario to use ER model for conceptual design of the database	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3												1	
CO4	3												2	
CO5		3				1	1		1	1				2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**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 Languages and Interfaces, Database System environment, Centralized and Client-Server Architecture for DBMSs.	**CO1**
II	**Relational Model:** The Relational Model Concepts, Relational Model Constraints and Relational Database Schemas. SQL: Data Definition, Constraints, and Basic Queries and Updates, SQL: Advanced Queries, Assertions, Triggers, and Views Formal Relational Languages: Relational Algebra: Unary Relational Operations: Select and Project, Relational Algebra Operations from Set Theory, Binary Relational Operations: Join and Division, Examples of Queries in Relational Algebra.	**CO1,CO2, CO3**
III	**Conceptual Data Modeling:** High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher Than Two. Relational Database Design Using ER-to-Relational Mapping.	**CO1,CO3, CO5**
IV	**Database Design Theory:** Functional Dependencies, Normal forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multi valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	**CO1,CO4**
V	**Transaction Processing:** Introduction, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability & Serializability, Transaction Support in SQL. Introduction to Concurrency Control: Two-Phase Locking Techniques: Types of Locks and System Lock Tables, Guaranteeing Serializability by Two-Phase Locking. Introduction to Recovery Protocols: Recovery Concepts, No-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging.	**CO1**

Learning Resources
Text Books
1. Database Systems Models, Languages, Design and Application Programming, Ramez Elmasri, Shamkant B. Navathe, Sixth edition, Pearson.
References
1. Data base System Concepts, Abraham Silberschatz, Henry F Korth, S. Sudarshan, Fifth Edition, McGraw Hill. 2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, Third Edition, TMH. 3. Introduction to Database Systems, C.J.Date, Eigth Edition , Pearson
e-Resources and other Digital Material:
1. https://nptel.ac.in/courses/106/105/106105175/ 2. https://onlinecourses.nptel.ac.in/noc21_cs04/ 3. https://nptel.ac.in/courses/106/106/106106093/

Internet of Things Lab

Course Code	19ES1552	Year	III	Semester	I
Course Category	ES	Branch	All	Course Type	Practical
Credits	1	L-T-P	0-0-2	Prerequisites	Problem Solving and Programming Lab
Continuous Internal Evaluation :	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Develop various sensor interfacing using Visual Programming Language	L6
CO2	Analyze various Physical Computing Techniques	L4
CO3	Evaluate Wireless Control of Remote Devices	L5
CO4	Design and develop Mobile Application which can interact with Sensors and Actuators	L6

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	3	2	3	3	3	3	2	2
CO2	3	3	3	3	2	3	3	2	3	3	3	3	2	2
CO3	3	3	3	3	2	3	3	2	3	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	3	3	3	2	2

Syllabus		
EXP No.	**Contents**	**Mapped CO**
1	Digital I/O Interface - Multicolour Led, IR Sensor, PIR, Slot Sensor.	**CO1**
2	Analog Read and Write - Potentiometer, Temperature Sensor, Led Brightness Control.	**CO1**
3	Dc Motor Control - Dc Motor Speed and Direction Control.	**CO2**
4	Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network.	**CO2**
5	Fabrication and direction control of wheeled robot using Arduino	**CO2**
6	Serial Communication - Device Control.	**CO2**
7	Wireless Module Interface - Bluetooth and Wifi.	**CO3**
8	Wireless Control of wheeled Robot using Bluetooth/Wifi.	**CO3**
9	Basic Android App Development using MIT App Inventor.	**CO4**
10	Smart Home Android App Development using App Inventor and Arduino.	**CO4**
Learning Resources		
Text Books		
1. Sylvia Libow Martinez, Gary S Stager, "Invent To Learn: Making, Tinkering, and Engineering in the Classroom", Constructing Modern Knowledge Press, 2016.		
References		
1. Michael Margolis, "Arduino Cookbook", Oreilly, 2011.		

Software Engineering Lab

Course Code	19CS3551	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Object Oriented Programming
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply analysis, design and visual modelling concepts for analyzing concern case studies	L3
CO2	Implement visual model experimentation as an individual, or team member by using modelling tools.	L3
CO3	Develop an effective report based on various case studies analyzed	L3
CO4	Apply analytical knowledge for a given case study and express with an effective oral communication.	L3
CO5	Analyze outputs generated through modelling tools	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	1	1
CO2					3				3					
CO3										3				
CO4	3									3				
CO5		3												

Syllabus		
Unit No.	**Contents**	**Mapped CO**
1	Develop UML behavioral and structural diagrams for a given scenario	**CO1,CO2,CO3, CO4,CO5**
2	**Prepare a SRS document in line with the IEEE recommended standards for the below case study** An automated teller machine (ATM) or the automatic banking machine (ABM) is banking subsystem that provides bank customers with access to financial transactions in a public space without the need for a cashier, clerk or bank teller. Customer uses bank ATM to check balances of his/ her bank accounts, deposit funds, withdraw cash and/or transfer funds. ATM technician provides maintenance and repairs	**CO1,CO2,CO3, CO4,CO5**
3	**A Point-of-Sale (POS) System** A retail POS system typically includes a computer, monitor, keyboard, barcode scanners, weight scale, receipt printer, credit card processing system, etc. and POS terminal software. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively fault tolerant; that is, even if remote services are temporarily unavailable they must still be of capturing sales and handling at least cash payments. A POS system must support multiple and varied client-side terminals and interfaces such as browser, PDAs, touch-screens	**CO1,CO2,CO3, CO4,CO5**
4	**Credit Card Processing System** Credit card processing system (Credit card payment gateway) is a system under consideration. Main part of the system is the Merchant's Credit Card Processing System. The merchant submits a credit card transaction request to the credit card payment gateway on behalf of a customer. Bank which issued customer's credit card which could approve or reject the transaction. If transaction is approved, funds will be transferred to merchant's bank account.	**CO1,CO2,CO3, CO4,CO5**
5	**Hospital Management System** Hospital management system is a large system including several subsystems or modules providing variety of functions. Hospital subsystem or module supports some of the many job duties of hospital receptionist. Receptionist schedules patient's appointments and admission to the hospital, collects information from patient upon patient's arrival and/or by phone. For the patient that will stay in the hospital ("inpatient") she or he should have a bed allotted in a ward. Receptionists might also receive patient's payments, record them in a database and provide receipts, file insurance claims and medical reports.	**CO1,CO2,CO3, CO4,CO5**
6	Apply software development life cycle activities on student interested case study and prepare an effective report.	**CO1,CO2,CO3, CO4,CO5**

Learning Resources
Text Book
1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, Seventh edition, 2009, McGraw Hill, International Edition.
References
1. Software Engineering, K.K. Agarwal &Yogesh Singh, 2007, New Age International Publishers. 2. Software Engineering, Ian Sommerville, Seventh edition, 2004, Pearson,India. 3. Software Engineering Principles and Practice, Waman S Jawadekar, McGrawHill, 2004. 4. Fundamentals of Software Engineering, Rajib Mall, Fourth edition, 2009, PHI.
e-Resources and other Digital Material
1. https://onlinecourses.nptel.ac.in/noc20_cs68

Database Management Systems Lab

Course Code	19CS3552	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Problem Solving and Programming Lab
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply database management techniques to solve problems	**L3**
CO2	Implement experiments by using modern tools like MYSQL, Oracle	
CO3	Develop an effective report based on various constructs implemented.	
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs of queries for a given problem	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	1	1
CO2					3				3					
CO3										3				
CO4	3									3				
CO5		3												

Syllabus		
EXP No.	**Contents**	**Mapped CO**
1	Introduction to MySQL Workbench. How to use MySql Workbench to run SQL Statements.	**CO1,CO2,CO3,CO4, CO5**
2	Examples on i) DDL Commands: CREATE , ALTER, DROP and TRUNCATE a Table ii) Implementation of Constraints PRIMARY KEY, FOREIGN KEY, CHECK, NOT NULL, UNIQUE.	**CO1,CO2,CO3,CO4, CO5**
3	Examples on i) DML Commands. INSERT, UPDATE and DELETE ii) DCL Commands: COMMIT , ROLLBACK and SAVEPOINT.	**CO1,CO2,CO3,CO4, CO5**
4	Examples on retrieving data from a single table using i) SELECT statement ii) SELECT statement with where clause(Comparison Operators, AND, OR, NOT, IN, BETWEEN,LIKE) iii) ORDER BY clause(sort by column name) iv) LIMIT clause	**CO1,CO2,CO3,CO4, CO5**
5	Examples on Functions in MySQL: String, Numeric, Date, Time and Other Functions.	**CO1,CO2,CO3,CO4, CO5**
6	Examples on Summary Queries: Queries using Aggregate functions, GROUP By and Having Clauses, ROLLUP Operator.	**CO1,CO2,CO3,CO4, CO5**
7	Examples on Inner join, outer join using USING, NATURAL Keywords	**CO1,CO2,CO3,CO4, CO5**
8	Examples on SUB/SUMMARY Queries Using IN, ANY, SOME, ALL , EXISTS and NOT EXISTS functions	**CO1,CO2,CO3,CO4, CO5**
9	Examples on i) Creating INDEXES and VIEWS ii) INSERT,DELETE and DROP on VIEWS	**CO1,CO2,CO3,CO4, CO5**
10	Examples on i) Create and Call STORED PROCEDURE (IN,OUT,INOUT Parameters) , Drop a STORED PROCEDURE. ii) Create, call and Drop a FUNCTION. iii) Create and Drop a TRIGGER	**CO1,CO2,CO3,CO4, CO5**
11	Case Study using real world database applications	**CO1,CO2,CO3,CO4, CO5**

Learning Resources

Text Books

1. Murach"s MySQL, JOEL MURACH, 2012, Shroff Publishers & Distributors Pvt. Ltd.

References

1. The Complete Reference MYSQL, Vikram Vaswani, 2017, McGrawHill Education.
2. DATABASE SYSTEMS Models, Languages, Design and Application Programming, Ramez Elmasri, ShamkantB. Navathe, Sixth Edition, Pearson.
3. Data base System Concepts, Abraham Silberschatz, Henry F Korth, S. Sudarshan, Fifth Edition, McGraw Hill.

Engineering Economics and Management

Course Category:	HSS	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO 1	To understanding of the fundamental concepts of Managerial economics and demand.
	CO 2	The ability to apply knowledge to evaluate future demand and theory of production.
	CO 3	To understanding of the foundational concepts of cost, market structure and role of pricing methods in business.
	CO 4	To understanding about the principles of management and human resource management function in an organization.
	CO 5	To understand the broad scope of marketing, societal, ethical and other diverse aspects of marketing and production.

Contribution of Course Outcomes towards achievement of Program Outcomes		**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**
	CO 1	3	3		2								3	3	
	CO 2	3	3		2								3	3	
	CO 3	3	3		2								3	3	
	CO 4	3	3		2								3	3	
	CO 5	3	3		2								3	3	
	1- Low					**2-Medium**								**3-High**	

Course Content

UNIT-1	**Introduction to Managerial Economics & Demand Analysis:** Definition of Managerial Economics, Nature and Scope – Managerial Economics and its relation with other subjects. Demand Analysis: Meaning - Demand determinants- Law of Demand and its exceptions.	**CO1**
UNIT-2	**Elasticity of Demand, Demand Forecasting & Theory of Production:** Definition -Types of Elasticity of demand - Measurement of price elasticity of demand. Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting. Production: Production Function- Law of variable proportions- Isoquants, Law of returns to scale.	**CO2**
UNIT-3	**Cost Analysis, Market Structures & Pricing:** Cost concepts - Break-Even Point - Managerial Significance and limitations of BEP - (simple problems). Market: meaning characteristics of market and Types of market competition – Pricing strategies	**CO3**

UNIT-4	**Introduction to Management & Human Resource Management: Meaning,** nature, importance and Functions of Management, Henri Fayol principles. HRM: objective and function, manpower planning, sources of recruitment.	**CO4**
UNIT-5	**Introduction to Marketing Management & Production management:** Meaning, Concepts of Marketing, Marketing Mix, Marketing Segmentation. Production management: objectives, Types of Plant Layout , location – Factors effecting it	**CO5**

References:

1. Managerial Economics and Financial Analysis, J.V.Prabhakar Rao, Maruthi Publications, 2011
2. Managerial Economics and Financial Analysis, N. Appa Rao. & P. Vijaya Kumar, Cengage Publications, New Delhi, 2011.
3. Managerial Economics and Financial Analysis, A R Aryasri, TMH, 2011.
4. Management Science, Aryasri, TMH, 2004.
5. Management Science, Rajesh C. Jampala, P. Adi Lakshmi, Duvuri Publications, Machilipatnam, 2010.

Compiler Design

Course Code	19CS3601	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Formal Languages and Automata Theory
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamental concepts in Compiler Design	**L2**
CO2	Apply scanning of tokens to perform the Lexical Analysis and Semantic analysis using attribute grammar	**L3**
CO3	Apply the various parsing techniques to generate the parse trees.	**L3**
CO4	Analyze various code optimization techniques for intermediate code forms and Code Generation.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3			1	
CO4		3											1	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Language Processors:** Overview of language processing system:– preprocessors – compiler – assembler – Linkers & loaders, difference between compiler and interpreter- structure of a compiler:–phases of a compiler. **Lexical Analysis: -** Role of Lexical Analysis – Input Buffering – Specification of Tokens – Recognition of Token – The Lexical Analyzer Generator (LEX).	**CO1,CO2**
II	**Syntax Analysis: –**Introduction: - Role of a parser – Context Free Grammar – Writing Grammar. **Top Down Parsing: –** Recursive Descent Parsing-FIRST and FOLLOW- LL(1) Grammar – Non recursive Predictive Parsing- Error Recovery in Predictive Parsing.	**CO1,CO3**
III	**Bottom up Parsing: –** Reductions – Handle Pruning - Shift Reduce Parsing – Conflicts During Shift–Reduce Parsing. **Introduction to simple LR Parsing: –** Why LR Parsers – Model of an LR Parsers — Construction of SLR Tables. **More powerful LR parsers:** -Canonical LR(1) items ,Construction of CLR (1) parsing table – Construction of LALR Parsing tables.	**CO1,CO3**
IV	**Syntax Directed Translation:** Syntax Directed Definitions, Evaluation Orders for SDD‟s, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes for Postfix Translation Schemes –Parser Stack Implementation of Postfix SDT‟s. **Runtime Environment: -** Storage organization - Stack allocation – Static allocation - Heap management-Introduction to Garbage Collection. **Intermediate code: -** Variants of Syntax Trees - Three address code – Quadruples - Triples - Indirect Triples.	**CO1,CO2**
V	**Optimization of Basic Blocks: –** DAG representation of basic block. Machine independent code optimization - Common sub expression elimination - Constant folding - Copy propagation -Dead code elimination - Strength reduction - Loop optimization. **Machine dependent code optimization: -** Peephole optimization – Register allocation - Instruction scheduling - Inter Procedural Optimization - Garbage collection via reference counting.	**CO1,CO4**

Learning Resources
Text Books
1. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Second Edition, Pearson Education.
References
1. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University. 2. Principles of compiler design, V. Raghavan, Second edition, 2011, TMH. 3. Compiler Design, Muneeswaran K. First Edition, 2012, Oxford University Press.
e-Resources and other Digital Material

1. http://www.nptel.iitm.ac.in/downloads/106108052/
2. http://www.vssut.ac.in/lecture_notes/lecture1422914957.pdf

Program Elective-II

Soft Computing

Course Code	19CS4601A	**Year**	III	**Semester**	II
Course Category	Program Elective-II	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Mathematics, Probability and Statistics
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of soft computing techniques and their applications	**L2**
CO2	Apply fuzzy logic to handle uncertainty and solve problems.	**L3**
CO3	Apply genetic algorithms to solve engineering problems	**L3**
CO4	Apply Nature Optimization algorithms for real-time problems.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3					1	1		1	1			1	
CO3	3					1	1						1	1
CO4	3					1	1							2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Soft Computing:** Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing **Applications of Soft computing techniques:** Handwritten Script Recognition, Image Processing and Data Compression, Automotive Systems and Manufacturing, Soft computing based Architecture, Decision Support System.	**CO1**
II	**Fuzzy Set Theory:** Fuzzy Versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations. Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based Systems, Defuzzification Methods	**CO1, CO2**
III	**Fundamentals of Genetic Algorithms:** Genetic Algorithms: History, Basic Concepts, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction.	**CO1, CO3**
IV	**Nature-Inspired Optimization Algorithms:** Differential Evolution, Ant and Bee Algorithms, Particle Swam Optimization.	**CO1,CO4**
V	**Nature-Inspired Optimization Algorithms:** The Firefly Algorithm, Cuckoo Search, The Bat Algorithm, The Flower Algorithm, Parameter Tuning and Parameter Control.	**CO1,CO4**

Learning Resources
Text Books
1. Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications, S. Rajasekaran, G. A. Vijayalakshmi Pai, 2017, PHI Learning. 2. Nature – Inspired Optimization Algorithms, XIN- SHE YANG, Second Edition, 2020, Elsevier.
Reference Books
1. Principles of Soft Computing, S.N.Sivanandam, S.N.Deepa, Wiley India Pvt. Ltd., 2018, Paperback. 2. Genetic Algorithms: Search and Optimization. E. Goldberg. 3. Fuzzy Sets and Fuzzy Logic-Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall, 2015, Paperback. 4. First course on Fuzzy Theory and Applications, Kwang H. Lee, 2005, Springer. 5. Neuro Fuzzy and Soft Computing, S. R. Jang, C.T. Sun and E. Mizutani, 2004, PHI / Pearson Education. 6. Neural Networks Algorithms, Applications, and Programming Techniques, James A. Freeman and David M. Skapura, 2003, Addison Wesley.
e-Resources & Other Digital Material
1. https://nptel.ac.in/courses/106/105/106105173/ 2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html#resources

Cryptography and Information Security

Course Code	19CS4601B	**Year**	III	**Semester**	II
Course Category	Program Electi - II	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Number Theory and Cryptography
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the need of security over the network	L2
CO2	Apply various cryptographic techniques for providing authentication.	L3
CO3	Apply various Key Management Techniques for secure key sharing.	L3
CO4	Apply various security protocols for real-time applications.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3							1						
CO2	3												2	
CO3	3								3	3			1	
CO4	3					1	1							1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Security Concepts:** Introduction, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security **Symmetric Key Ciphers:** Block Cipher Principles, Blow fish, IDEA, Stream Ciphers, RC4	**CO1,CO2**
II	**Cryptographic Hash Functions:** Message Authentication, Secure Hash Algorithm(SHA-512) Message Authentication Codes: Message Authentication Requirements, MAC"s Based on Block Ciphers: DAA and CMAC **Digital Signatures:** Digital Signatures, Schnorr Digital Signature, NIST Digital Signature Algorithm	**CO1,CO2**
III	**Key Management and Distribution:** Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates. Public-Key Infrastructure.	**CO1,CO3**
IV	**Transport-Level Security:** Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell(SSH)	**CO1,CO4**
V	**Email Security:** Pretty Good Privacy, S/MIME **IP Security**: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange	**CO1,CO4**

Learning Resources
Text Books
1. William Stallings. Cryptography and Network Security – Principles and Practice, Seventh edition, 2017, Pearson Education.
References
1. Cryptography and Network Security, Atul Kahate, Third edition, 2013, Mc Graw Hill. 2. Cryptography and Network Security, C K Shyamala, N Harini, Dr T R Padmanabhan. First edition, 2011, Wiley India. 3. Cryptography and Network Security, Forouzan and Mukhopadhyay, Third edition, 2015, Mc Graw Hill. 4. Information Security, Principles, and Practice, Mark Stamp, 2011, Wiley India. 5. Principles of Computer Security, WM. Arthur Conklin and Greg White, 2016, TMH. 6. Introduction to Network Security, Neal Krawetz, 2007, CENGAGE Learning.
e-Resources & Other Digital Material
1. http://nptel.ac.in/courses/106105031/lecture, Dr. Debdeep Mukhopadhyay, IIT Kharagpur 2. https://www.coursera.org/learn/information-security-data 3. https://www.coursera.org/learn/number-theory-cryptography

Design Patterns

Course Code	19CS4601C	**Year**	III	**Semester**	II
Course Category	Program Elective-II	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Databases and Object oriented design and programming.
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the concept of Design patterns for problems and solutions.	**L2**
CO2	Apply creational patterns in software design for class instantiation.	**L3**
CO3	Apply structural and behavioral patterns to develop design solutions.	**L3**
CO4	Analyze design solutions by using structural patterns for given case studies.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3					1	1		1	1			1	
CO4		3				1	1							2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.	**CO1**
II	**Creational Patterns:** Abstract Factory, Builder, Factory Method, Prototype, Singleton.	**CO1, CO2**
III	**Structural Patterns:** Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.	**CO1, CO3,CO4**
IV	**Behavioral Patterns:** Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, Strategy, Template Method, Visitor. Conclusion: What to Expect from Design Patterns, The Pattern Community.	**CO1,CO3**
V	**A Case Study:** Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.	**CO1, CO2,CO3**

Learning Resources
Text Book
1. Design Patterns Elements of Reusable Object-Oriented Software, Erich Gamma, First edition, 1995, Pearson Education.
References
1 Head First Design Patterns, by Eric Freeman, Elisabeth Robson, First Edition, 2004, O'Reilly Media, Inc. 2. Peeling Design Patterns, by Prof.Meda Sreenivasa Rao, Narasimha Karumanchi, First Edition, 2017, CareerMonk Publications. 3. JAVA Enterprise Design Patterns Vol-III, Mark Grand , 2001, Wiley Dream Tech.
e-Resources and other Digital Material
1. https://www.coursera.org/learn/design-patterns. 2. https://www.coursera.org/learn/uml. 3. https://www.coursera.org/learn/object-oriented-design. 4. https://sourcemaking.com/design-patterns-ebook.

Unix Operating Syste ms

Course Code	19CS4601D	**Year**	III	**Semester**	II
Course Category	Program Elective-II	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Operating Systems
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of UNIX systems.	**L2**
CO2	Apply the concepts of process subsystem in uniprocessor and multiprocessor systems	**L3**
CO3	Apply the concepts of file systems in Unix kernels	**L3**
CO4	Analyze various schedulers for different types of processes.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3												2	
CO4		3							2	2				2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to UNIX**: The process and the kernel, Mode, space and context, Process abstraction, Executing in kernel mode, synchronization, and process scheduling.	**CO1,CO2**
II	**Introduction to Threads** : Fundamental abstractions, Lightweight process design, Issues to consider, User level thread libraries, scheduler activations	**CO1,CO2**
III	**Process Scheduling**: Clock interrupts handling, Scheduler Goals, Traditional UNIX scheduling, Solaris 2.x Scheduling Enhancements.	**CO1,CO2,CO4**
IV	**Synchronization and Multiprocessing**: Introduction, Synchronization in Traditional UNIX Kernels, Multiprocessor Systems, Multiprocessor synchronization issues, Semaphores, spin locks, condition variables, Read-write locks, Reference counts.	**CO1,CO2,CO3**
V	**File system interface and framework** : The user interface to files, File systems, Special files, File system framework, The Vnode/Vfs architecture, Implementation Overview, File System dependent objects, Mounting a file system, Operations on files. **File System Implementations** : System V file system (s5fs) implementation, Berkeley FFS, FFS functionality enhancements and analysis, Temporary file systems, Buffer cache and other special-purpose file systems.	**CO1,CO3**

Learning Resources
Text Books
1. UNIX Internals, UreshVahalia, 2005, Pearson Education.
References
1.Uresh Vahalia, UNIX Internals, Pearson Education, 1997 2. Advanced Programming in the UNIX Environment, Richard Stevens, Stephen A. Rago, Second edition, 2005, Pearson Education.
e-Resources and other Digital Material
1. https://www.tutorialspoint.com/unix/index.html 2. https://www.cse.iitb.ac.in/~mythili/teaching/cs347_autumn2016/notes/09-filesystem-io.pdf

Machine Learning

Course Code	19CS3602	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Linear, algebra, Statistics and Probability
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of machine learning.	**L2**
CO2	Apply learning techniques on appropriate problems.	**L3**
CO3	Apply Evaluation, hypothesis tests and compare learning techniques for various problems.	**L3**
CO4	Apply Reinforcement learning to address the real time problems in different areas.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO2**
CO1	3													
CO2	3					2	2							
CO3	3								1	1			1	1
CO4	3					1	1							2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction**: What is Machine learning, Designing a Learning System, Perspectives and Issues in Machine Learning, Applications of Machine learning.	**CO1**
II	**Supervised Learning**: Decision Trees, Bayes Theorem, Naive Bayes Classifier, Measuring Classifier Accuracy, Estimating Hypothesis Accuracy.	**CO1,CO2,CO3**
III	**Instance Based Learning** – Support vector machine, Ensemble Methods, k-Nearest Neighbor Learning, Expectation Maximization Algorithm, Case Based Reasoning.	**CO1,CO2,CO3**
IV	**Un Supervised Learning:** Partition methods of Clustering, Hierarchical methods, Density based clustering, Scalable Clustering Algorithms, Cluster Evaluation measures. **Association analysis**: Apriori algorithm, efficiently finding frequent itemsets with FP-growth.	**CO1,CO2,CO3**
V	**Reinforcement learning**: The learning Task, Elements of Reinforcement learning, Q-Learning, Model based Learning, Temporal Difference learning.	**CO1,CO4**

Learning Resources
Text Book
1. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India. 2. Machine Learning, Anuradha Srinivasaraghavan, and Vincy Joseph, Kindle Edition, 2020, WILEY.
References
1. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education. 2. "Deep Learning", Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, MIT Press. 3. Machine Learning a Probabilistic Perspective, Kevin P Murphy & Francis Bach, First Edition, 2012, MIT Press. 4. Introduction to Data Mining, Tan, Vipin Kumar, Michael Steinbach, Nineth Edition, 2013, Pearson
e-Resources and other Digital Material
1.https://www.coursera.org/learn/machine-learning 2.https://nptel.ac.in/courses/106/106/106106139/

Program Elective-III

Neural Networks

Course Code	19CS4602A	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Linear, algebra, Statistics and Probability
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamentals and types of neural networks, Fuzzy logic principles.	**L2**
CO2	Apply Back propagation networks for various problems	**L3**
CO3	Apply Associative memory and Adoptive resonance theory for real world problems.	**L3**
CO4	Apply ANN techniques for solving various problems	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3					1	1							2
CO3	3					1			2	2				
CO4	3					1	1							2

UNIT-1	**Introduction to Artificial Intelligence System**: Neural Network, Fuzzy logic, Genetic Algorithm. **Fundamentals of Neural Networks:** Basic Concepts of Neural Network, Human Brain, Model of Artificial Neuron **Neural Network Architecture**: Single layer Feed-forward networks, Multilayer Feed-forward networks, Recurrent Networks Characteristics of Neural networks, Learning methods	**CO1**
UNIT-2	**Back propagation Networks:** Architecture of Back-propagation (BP) Networks, Back-propagation Learning – Input Layer Computation, Hidden Layer Computation, Output layer Computation, Calculation of Error, Training of neural network, Back Propagation Algorithm	**CO1,CO2**
UNIT-3	**Associative Memory:** Introduction, Autocorrelators, Heterocorrelators, Wang et al‟s Multiple Training Encoding Strategy, Applications	**CO1,CO3**
UNIT-4	**Adaptive Resonance Theory:** Introduction - Classical ART networks, Simplified ART architectures, ART1-ART1-Architectre, ART2-Architecture of ART2, Applications-Character recognition using ART1	**CO1,CO3**
UNIT-5	**Applications of ANN:** Introduction, Direct applications - Pattern Classification, Associative memories, Application areas -Applications in speech, applications in image processing	**CO1,CO4**

Learning Resources
Text Books
1. Neural Networks, Fuzzy Logic and Genetic Algorithms, S.Rajasekaran and G.A. Vijayalakshmi Pai, second edition, 2017, PHI Publications. 2. Artificial neural network, B. Yegnanarayana, PHI Publication.
Reference Books
1. Neural Networks for Pattern Recognition, Bishop, C. M., 1995, Oxford University Press. 2. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI. 3. Build Neural Network with MS Excel sample by Joe choong.
e-Resources & Other Digital Material
1. https://www.coursera.org/learn/neural-networks-deep-learning 2. https://www.coursera.org/learn/machine-learning

Cyber Security

Course Code	19CS4602B	**Year**	III	**Semester**	II
Course Category	Program Electi - III	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Number Theory and Cryptography
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basics of cybercrime and offences	L2
CO2	Apply various security measures on mobile devices for a given scenario.	L3
CO3	Apply various methods and tools used in Cyber Crime.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3							1				1		
CO 2	3					2			1	1				2
CO 3		3				2								2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Cybercrime:** Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of **Cybercrimes, And Cybercrime:** The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA2000, A Global Perspective on Cybercrimes.	**CO1**
II	**Cyber Offenses:** How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, **Cyber cafe and Cybercrimes, Botnets** : The Fuel for Cybercrime, Attack Vector, and Cloud Computing.	**CO1**
III	**Cybercrime:** Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.	**CO1,CO2**
IV	**Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.	**CO1,CO3**
V	**Cyber Security:** Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.	**CO1,CO3**

Learning Resources
Text Books
1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Prespectives, Nina Godbole and Sunil Belapure, First edition, 2011, Wiley INDIA.
References
1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, First edition, 2011, CRC Press. 2. Chwan-Hwa(John) Wu,J.David Irwin, Introduction to Cyber Security, First edition, 2013, CRC Press T&F Group.
e-Resources & Other Digital Material
1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep Mukhopadhyay, IIT Kharagpur

Software Metrics

Course Code	19CS4602C	**Year**	III	**Semester**	II
Course Category	Professional Elective-III	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Software Engineering
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand various fundamentals of measurement and software metrics	**L2**
CO2	Apply frame work and analysis techniques for software measurement.	**L3**
CO3	Apply internal and external attributes of software product for effort estimation.	**L3**
CO4	Apply reliability models for predicting software quality	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3								3	3				
CO4	3												2	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Fundamentals of Measurement:** Measurement: what is it and why do it?: Measurement in Software Engineering, Scope of Software Metrics, **The Basics of measurement**: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement	**CO1**
II	**A Goal-Based Framework For Software Measurement:** Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing Software Measurement validation **Empirical investigation**: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments ,Relevant and Meaningful Studies	**CO1,CO2**
III	**Software Metrics Data Collection:** Defining good data ,Data collection for incident reports, How to collect data, Reliability of data collection Procedures **Analyzing software measurement data:** Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques	**CO2**
IV	**Measuring internal product attributes: Size** Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures **Measuring internal product attributes: Structure:** Aspects of Structural Measures, Control flow structure of program units, Design-level Attributes, Object-oriented Structural attributes and measures	**CO3**
V	**Measuring External Product Attributes:** Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures, Security Measures **Software Reliability: Measurement and Prediction:** Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy	**CO3,CO4**

Learning Resources

Text Books

1. Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014

References

1. Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997
2. Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison-Wesley Professional.
3. Measuring the Software Process, William A. Florac and Areitor D. Carletow, 1995, Addison – Wesley.
4. Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.

Cloud Computing

Course Code	19CS4602D	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Computer Networks, Operating Systems
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		
CO1	Understand the basic concepts of Cloud Computing.	**L2**
CO2	Apply cloud computing services to commercial systems for deploying cloud	**L3**
CO3	Apply cloud computing concepts in various business sectors.	**L3**
CO4	Analyze different platforms in industry for building and training in cloud computing-related IT areas	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3								3	3				
CO3	3					2							2	
CO4		3				2								1

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Cloud:** Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments. **Virtualization:** Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V.	**CO1**
II	**Cloud Computing Architecture :** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance.	**CO1**
III	**Aneka:** Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.	**CO1,CO2**
IV	**Cloud Applications:** Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.	**CO1,CO3**
V	**Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure.	**CO1,CO4**

Learning Resources
Text Books
1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, 2013, TMH.
References
1. Rajkumar Buyya, JamesBroberg, AndrzejGoscinski, Cloud Computing Principles and Paradigms, Wiley Publishing inc. 2. George Reese, "Cloud Application Architectures", First Edition, O"Reilly, Media 2009. 3. Micheal Miller, "Cloud Computing – web based Applications that change the way you work and

collaborate Online", .Pearson Education.
E-Resources and other Digital Material
1. http://www.slideshare.net/himanshuawasthi2109/cloud-computing-ppt-16240131 2. http://nptel.ac.in/courses/106105033/41 3. https://www.youtube.com/watch?v=r8Lu_BjxlZc 4. http://video.mit.edu/watch/mitef-nyc-cloud-computing-8347/

Web Application Development

Course Code	19CS3603	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	JAVA
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamental concepts of web application development.	**L2**
CO2	Apply HTML, CSS and Java Script to create static and dynamic web pages.	**L3**
CO3	Apply JDBC API to interact with database.	**L3**
CO4	Apply the concepts of server side technologies for dynamic web applications.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3					1	1		2	2				
CO3	3					1	1						1	1
CO4	3					1	1						1	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**HTML:** Understanding 3-tier Web Architecture, Overview of HTTP, Introducing HTML document structure, Creating Headings on a web page, Working with links, Creating a Paragraph, Working with images, Working with tables, working with frames, Introduction to Forms and HTML controls. **Cascading Style Sheets:** Inline, Internal and External Style Sheets, Style class, Multiple styles.	**CO1, CO2**
II	**JavaScript:** Introducing DHTML, Introducing JavaScript, Client Side benefits of using JavaScript, Embedding JavaScript in an HTML page, Using Variables, Using Operators, Working with Control Flow statements, Working with functions, Handling Events, Using Arrays, Creating objects in JavaScript. **XML**: Introduction to XML: Syntax of XML, document structure, and document type definition.	**CO1, CO2**
III	**JDBC:** Java Database Connectivity: JDBC Connectivity, Types of JDBC drivers, Steps to write a JDBC application, JDBC Statements, Manipulations on the database.	**CO1, CO3**
IV	**Servlets:** Introduction to Servlets: Lifecycle of a servlet, the servlet api, the javax.servlet package, the javax.servlet.http package, handling http request & responses, Servlets with database connectivity. Introduction to Model View Controller (MVC): Architecture.	**CO1, CO4**
V	**JSP:** Introduction to JSP: The problem with servlet, the anatomy of a JSP page, JSP processing, JSP applications, JSP components, comments, expressions, scriptlets, JSP database connectivity	**CO1, CO4**

Learning Resources

Text Books

1. Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press.
2. Jason Hunter, William Crawford, Java Servlet Programming, Second edition, 2003, O'Reilly, 2003
3. Robert W. Sebesta, Programming the World Wide Web, Fourth edition, 2007, Pearson.

References

1. Internet and World Wide Web - How to program, Dietel and Nieto, 2006, PHI/Pearson Education.
2. JAVA The Complete References, Herbert Schildt, Eighth edition, 2014, McGraw Hill.
3. Web Technologies, Uttam K. Roy, 2004, Oxford Higher Education publication.
4. Web Warrior Guide to Web Programming, Bai Ekedaw, 2012, Thompson Publications.

e-Resources and other Digital Material

1. www.w3schools.com
2. Prof. I. Sengupta. (14th, May, 2017), Department of Computer Science & Engineering, I.I.T.,Kharagpur, "Internet Technologies", NPTEL videos.

Engineering Ethics

Course Code	19CS3651	Year	III	Semester	II
Course Category	Mandatory Course	Branch	CSE	Course Type	Theory
Credits	1.5	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation :	100	Semester End Evaluation:	-	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the core values that shape the ethical behaviour of an engineer and Exposed awareness on professional ethics and human values.	**L2**
CO2	Understand the basic perception of profession, professional ethics, various moral issues &uses of ethical theories.	**L2**
CO3	Understand various social issues, Industrial standards, code of ethics and role of professional ethics in engineering field.	**L2**
CO4	Demonstrate responsibilities of an engineer for safety and risk benefit analysis, profession rights and responsibilities of an engineer.	**L3**
CO5	Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1	1	3	1	2				
CO2						1	1	3	1	2				
CO3						3	2	3		1				
CO4						3	2	1						
CO5						3	2	2		1	3			

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**HUMAN VALUES** Morals, values and Ethics –Integrity –Work ethic –Service learning –Civic virtue –Respect for others –Living peacefully –Caring –Sharing –Honesty –Courage –Valuing time –Cooperation –Commitment –Empathy –Self-confidence –Character –Spirituality –Introduction to Yoga and meditation for professional excellence and stress management.	**CO1**
II	**ENGINEERINGETHICS** Senses of "Engineering Ethics" –Variety of moral issues –Types of inquiry –Moral dilemmas –Moral Autonomy –Kohlberg"s theory –Gilligan"s theory –Consensus and Controversy – Models of professional roles –Theories about right action –Self-interest –Customs and Religion –Uses of Ethical Theories.	**CO2**
III	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation –Engineers as responsible Experimenters –Codes of Ethics – A Balanced Outlook on Law.	**CO3**
IV	**SAFETY, RESPONSIBILITIESAND RIGHTS** Safety and Risk –Assessment of Safety and Risk –Risk Benefit Analysis and Reducing Risk – Respect for Authority –Collective Bargaining –Confidentiality –Conflicts of Interest – Occupational Crime –Professional Rights –Employee Rights –Intellectual Property Rights (IPR) –Discrimination.	**CO4**
V	**GLOBAL ISSUES** Multinational Corporations – Business Ethics- Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers–Engineers as Expert Witnesses and Advisors –Honesty –Moral Leadership–Sample Code of Conduct.	**CO5**

Learning Resources
Text Books
1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004. 2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –Concepts and Cases", Cengage Learning, 2009
e- Resources & other digital material
www.onlineethics.org 2. www.nspe.org 3. www.globalethics.org 4. www.ethics.or

Compiler Design Lab

Course Code	19CS3651	Year	III	Semester	II
Course Category	Program Core	Branch	CSE	Course Type	Practical
Credits	1.5	L-T-P	0-0-2	Prerequisites	
Continuous Internal Evaluation :	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply C, LEX and YACC programming to write a solution for the phases of compiler problems.	**L3**
CO2	Implement programs as an individual on different IDEs.	**-**
CO3	Develop an effective report based on various programs implemented.	**-**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication.	**L3**
CO5	Analyze outputs generated by executing C, LEX and YACC programs for different test cases.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3											2	1	1
CO2					3				3			3		
CO3										3				
CO4	3									3				
CO5		3												

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
1	Design a Lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value.	**CO1,CO2,CO3,CO4,CO5**
2	(a) Implement the lexical analyzer using LEX program for the regular expression RE‟s: a(a+b)* (b) Implement the LEX program to implement RE‟s: (a+b)*abb(a+b)*	**CO1,CO2,CO3,CO4,CO5**
3	(a) Implement the lexical analyzer using JLEX, FLEX or LEX or other lexical analyzer generating stools. (b) Implement the lexical analyzer Program to count no of +ve and – ve integers using LEX	**CO1,CO2,CO3,CO4,CO5**
4	(a) Implement the lexical analyzer Program to count the number of vowels and consonants in a given string. (b) Implement the lexical analyzer Program to count the number of characters, words, spaces, end of lines in a given input file.	**CO1,CO2,CO3,CO4,CO5**
5	Implement a „C‟ program to calculate First and Follow sets of given grammar	**CO1,CO2,CO3,CO4,CO5**
6	Design Predictive parser for the given language.	**CO1,CO2,CO3,CO4,CO5**
7	Implementation of Shift Reduce Parsing Algorithm.	**CO1,CO2,CO3,CO4,CO5**
8	Design LALR bottom up parser for the given language. (Implementation of calculator using YACC)	**CO1,CO2,CO3,CO4,CO5**
9	Convert the BNF rules into YACC form and write code to generate abstract syntax tree.	**CO1,CO2,CO3,CO4,CO5**
10	Generation of Code for a given Intermediate Code.	**CO1,CO2,CO3,CO4,CO5**

Learning Resources

Text Books

1. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ulman, Second Edition, Pearson Education.
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

References

1. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O‟reilly
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.

3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson.
5. Principles of compiler design, V. Raghavan, Second edition, TMH, 2011.

e-Resources and other Digital Material

1. http://www.nptel.iitm.ac.in/downloads/106108052/

Web Application Development Lab

Course Code	19CS3652	**Year**	III	**Semester**	II
Course Category	Program Core La	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	3-0-0	**Prerequisites**	JAVA
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply web technologies to develop applications.	**L3**
CO2	Implement various applications as an individual or team member	**-**
CO3	Develop an effective report based on various programs implemented	**-**
CO4	Apply technical knowledge for a given problem and express with an effective oral communication	**L3**
CO5	Analyze outputs of web based applications	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3					1	1					2	1	1
CO2					3				3					
CO3										3				
CO4	3									3				
CO5		3												

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
1	Design static web sites with html tags by taking different examples.	**CO1, CO2, CO3, CO4, CO5**
2	Design web pages using different types of CSS.	**CO1, CO2, CO3, CO4, CO5**
3	Apply Client side validations using JavaScript	**CO1, CO2, CO3, CO4, CO5**
4	Create an XML file for student/employee/book data and validate against DTD	**CO1, CO2, CO3, CO4, CO5**
5	Develop different JDBC applications to interact with database.	**CO1, CO2, CO3, CO4, CO5**
6	Create different web applications using servlets	**CO1, CO2, CO3, CO4, CO5**
7	Develop different web applications using JSP	**CO1, CO2, CO3, CO4, CO5**
8	Build web applications (case studies) based on the **choice of student/faculty**	**CO1, CO2, CO3, CO4, CO5**

Learning Resources

Text Books

1. Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press, 2009
2. JavaServer Pages, Hans Bergsten, Thirrd Edition, 2017, O,,Reilly Media

Reference Books:

1. The Complete reference to J2EE, Jim Keogh, 2017, Tata McGrawHill.
2. Advanced Java 2 Platform How to Programl, H. M. Deitel, P.J. Deitel, S.E. Santry, Third Edition, 2016, Prentice Hall Publications.
3. Java Servlet Programming, Jason Hunter, William Crawford, Second edition, 2003 O'Reilly.

e- Resources & other digital material

1. www.w3schools.com
2. Prof. I. Sengupta. (14th, May, 2017), Department of Computer Science & Engineering, I.I.T.,Kharagpur,"Internet Technologies", NPTEL videos.

Organization Behaviour

Course Category:	HS	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisites:	Nil	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Demonstrate the applicability of the concept of organizational behaviour to understand the behaviour and culture of people in the organization.
CO2	Demonstrate the applicability of analyzing the complexities associated with management of individual behaviour in the organization.
CO3	Analyze the complexities associated with management of the group behaviours (Group Dynamics) in the organization and role of leadership.
CO4	Demonstrate how the organizational behaviour can integrate in understanding the motivation for creating positive work culture.
CO5	Demonstrate how the organizational behaviour can influence in understanding the importance of learning and leadership for an organization to create positive impact.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								3	3		2			3
CO2								3	3		2			3
CO3								3	3		2			3
CO4								3	3		2			3
CO5								3	3		2			3

Course Content		
UNIT-1	**Introduction to Organizational Behaviour and Culture:** Definition-Nature- Scope-Roles of Manager- Challenges-Opportunities- Creating and Maintaining Organizational Culture	**CO1**
UNIT-2	**Foundations of Individual Behaviour:** Perception: Definition-Factors- The Perception Process- Motivation: Definition- Factors-Theories of Motivation: Maslow‟s Hierarchy Theory of Needs-Herzberg‟s Theory-Expectancy Theory	**CO2**
UNIT-3	**Foundations of Group Behaviour:** Group-Definition- Types of Groups- Stages of Group Development- Group Decision Making- techniques-Johari Window-Transactional Analysis	**CO3**
UNIT-4	**Managing Group Behaviour**- Team- Definition- Types of Teams- Team Building-Conflict – Intra-Personal and Inter Personal Conflict	**CO4**
UNIT-5	**Leadership**- Definition- Types- Theories of Leadership: Trait theories- Contingency theories-**Learning**- Definition- Theories of Learning	**CO5**

Learning Resources

Text Books

1. Aswathappa K., “Organizational Behavior-Text, Cases and Games”, Himalaya Publishing House, New Delhi, 2008.
2. Stephen B. Robbins, “Organizational Behavior”, PHI, New Delhi, 2008

Reference Books

1. Pareek Udai: “Understanding Organizational Behavior”, Oxford University Press, New Delhi, 2007.
2. Sharma V.S., Veluri: “Organizational Behavior”, JAICO Publishing House, New Delhi, 2009.
3. Mary Ann Von Glinow, Radha R. Sharma, Steven L. McShane, “Organizational Behavior”, Tata McGraw Hill Education, New Delhi, 2008.

Mobile ApplicationDevelopment

Course Code	19CS3701	**Year**	IV	**Semester**	I
Course Category	Program Core	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Java, Database Management Systems, Advanced Java and Web Technologies
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basic concepts of android studio development environment	**L2**
CO2	Apply UI components to develop applications.	**L3**
CO3	Apply Database APIs to develop applications	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2	2					1	1		3	3			1	1
CO3	2					1	1						2	2

Course Content		
UNIT-1	**Beginning Android and Java:** Introduction to Android Platform, Android vs. other mobile platforms, Android Stack, Android Versions, Why Java in Android?, How Java and Android work together, The structure of Android's Java code, Android emulator, Sample programs on emulator	**CO1**
UNIT-2	**Java, XML, and the UI Designer:** Examining the logcat output, Exploring the project Java and the main layout XML, Working with common widgets, Writing our first Java code, Activity life cycle demo app	**CO1, CO2**
UNIT-3	**Getting Started with Layouts:** Introducing layouts, Building a precise UI with Constraint Layout, Laying out data with Table Layout, Android Dialog Windows: Dialog windows, Coding the Fragment classes and their layouts	**CO3**
UNIT-4	**Data Persistence and Sharing:** Android intents, Switching Activity, Passing data between activities, Persisting data with Shared Preferences, Reloading data with Shared Preferences, What is JSON?	**CO4**
UNIT-5	**Android Databases:** What is a database? What is SQLite? SQL syntax primer, Android SQLite API, Coding the database class	**CO1,CO4**

Learning Resources

Text Books

1. Android Programming for Beginners: Build in-depth, full-featured Android apps starting from zero programming experience, John Horton, 3rd Edition, 2021, PACKT Publishers.

Reference Books

1. Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths, David Griffiths,2015, O′Reilly
2. Android 9 Development Cookbook, Rick Boyer, 3rd Edition, 2018, Packt Publishers
3. Android Programming: Pushing the Limits Paperback – Illustrated, Erik Hellman, 2013, Wiley
4. Professional Android, Reto Meier, Ian Lake, 4th Edition, 2018, Wrox

Program Elective-IV

Deep Learning

Course Code	19CS4701A	**Year**	IV	**Semester**	I
Course Category	Program Elective - IV	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Machine Learning, Neural Networks
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamental techniques and principles of deep learning.	**L2**
CO2	Apply concepts and major architectures of deep networks to build solutions for variety of problems.	**L3**
CO3	Apply Deep learning techniques to build applications in various domains.	**L3**
CO4	Analyze CNN techniques to classify images and detect objects.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3												1	
CO3	3					1	1							2
CO4		3				1	1		1	1				2

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**A Review of Machine Learning –** The Learning Machines, How Can Machines Learn? Biological Inspiration, What Is Deep Learning?, **Fundamentals of Deep Networks** – Defining Deep Learning, What Is Deep Learning? Common Architectural Principles of Deep Networks: Parameters, Layers, Activation Functions, Loss Functions, Hyper parameters.	**CO1, CO2**
II	**Building Blocks of Deep Networks –** RBMs, Autoencoders, Variational Autoencoders. **Major Architectures of Deep Networks:** Unsupervised pretrained networks, Deep Belief Networks, Generative Adversarial Networks.	**CO1, CO2**
III	**Convolutional Neural Networks (CNNs) –** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks, Applications.	**CO1, CO4**
IV	**Sequence Modeling – Recurrent and Recursive Nets** – Unfolding Computational Graphs, Recurrent Neural Networks, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs, Applications.	**CO1, CO3**
V	**Deep Learning applications –** Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.	**CO1, CO3**

Learning Resources

Text books

1. Deep learning: A practitioner's approach, Josh Patterson and Adam Gibson, First Edition, 2017, O'Reilly Media.
2. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, MIT Press.

References

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O‟Reilly,
2. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O‟Reilly, 2019, Shroff Publishers.

e-Resources and other Digital Material

1. https://www.deeplearningbook.org/
2. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
3. https://www.udemy.com/share/101X6W/ (or) https://www.udemy.com/course/deep-learning-advanced-nlp/
4. https://www.youtube.com/watch?v=5tvmMX8r_OM&list=PLtBw6njQRU-rwp5__7C0oIVt26ZgjG9NI

Adhoc Sensor Networks

Course Code	19CS4701B	**Year**	IV	**Semester**	I
Course Category	Program Elective - IV	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Computer Networks
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the Basic Concepts of Adhoc Sensor Networks	**L2**
CO2	Apply appropriate MAC Protocols for a given scenario	**L3**
CO3	Apply suitable Routing/Transport Protocols for a given scenario.	**L3**
CO4	Apply Data Dissemination/Localization aspects in the context of WSN	**L3**
CO5	Apply suitable QoS Framework/models to enhance quality of Service in WSN	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3			1	
CO4	3													1
CO5	3												1	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Adhoc Wireless Networks** – Introduction, Issues In Ad Hoc Wireless Networks, Ad Hoc Wireless Internet **Mac Protocols For Ad Hoc Wireless Networks** – Design Goals Of A Mac Protocol For Ad Hoc Wireless Networks, Classifications Of MAC protocols, Contention-Based Protocols, Contention-Based Protocols With Reservation Mechanisms, Contention-Based MAC protocols With Scheduling Mechanisms, Other MAC protocols.	**CO1**
II	**Routing Protocols For Ad Hoc Wireless Networks -** Issues In Designing A Routing Protocol For Ad Hoc Wireless Networks, Classifications Of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, **Multicast Routing In Ad Hoc Wireless Networks** – Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Energy-Efficient Multicasting	**CO1,CO2**
III	**Transport Layer And Security Protocols For Ad Hoc Wireless Networks** – Issues In Designing A Transport Layer Protocol For Ad Hoc Wireless Networks, Design Goals Of A Transport Layer Protocol For Ad Hoc Wireless Networks, Classification Of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Security In Ad Hoc Wireless Networks.	**CO1,CO3**
IV	**Wireless Sensor Networks And Mac Protocols** - WSN Network architecture, data dissemination, MAC Protocols For Sensor Networks: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC, Location Discovery	**CO1,CO4**
V	**Quality Of Service In Ad Hoc Wireless Networks** – QoS Frameworks For Ad Hoc Wireless Networks: QoS Models. **Quality Of A Sensor Network**, Other Issues - Energy Efficient Design-Synchronization-Transport Layer issues.	**CO1,CO5**

Learning Resources

Text Books

2. Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy and B.S. Manoj, 2004, Pearson Education.

References

1. Wireless Sensor Networks – An Information Processing Approach, Feng Zhao and Leonidas Guibas, 2004, Elsevier Publications.
2. Protocols and Architectures for Wireless Sensor Networks, Holger Karl and Andreas Willig, 2009, John Wiley and Sons.

e-Resources & Other Digital Material

1. https://nptel.ac.in/courses/106/105/106105160/
2. https://www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf

Agile Software Development

Course Code	19CS4701C	**Year**	IV	**Semester**	I
Course Category	Program Elective - IV	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Software Engineering, Software Metrics, Software project management
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamentals of agile methods in various development environments	**L2**
CO2	Apply the concepts of Xtreme programming in projects.	**L3**
CO3	Apply the Techniques of Feature-Driven Development to deliver tangible software results.	**L3**
CO4	Analyze the given scenario and chose appropriate Agile methods/ tools for software Development.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												1	
CO3	3								3	3				1
CO4		3			1									2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** The Agile manifesto, Agile methods, XP: Extreme Programming, DSDM, SCRUM, feature- Driven Development, modeling misconceptions, agile modeling, tools of misconceptions, updating agile models.	**CO1**
II	**Extreme Programming:** Introduction, core XP values, the twelve XP practices, about extreme programming, planning XP projects, test first coding, making pair programming work.	**CO1,CO2**
III	**Agile Modeling and XP**: Introduction, the fit, common practices, modeling specific practices, XP objections to agile modeling, agile modeling and planning XP projects, XP implementation phase	**CO1,CO2**
IV	**Feature-Driven Development:** Introduction, incremental software development, Regaining Control, The motivation behind FDD, planning an iterative project, architecture centric, FDD and XP	**CO1,CO3**
V	**Agile Methods with RUP and PRINCE2 and Tools and Obstacles**: Agile modeling and RUP, FDD and RUP, agile methods and prince2, tools to help with agile development, Eclipse, An agile IDE, obstacles to agile software development, management intransigence, the failed project syndrome, contractual difficulties, familiarity with agility.	**CO1,CO4**

Learning Resources
Text Books
1. Agile and Iterative Development: a manager‟s guide, Craig Larman, First edition, 2004, Addison Wesley.
References
1. The Art of Agile Development, Pearson, Robert C. Martin, Juli, James Shore, Chromatic, First edition, 2013, O'Reilly Media. 2. Software Project Management, Rajib mal, Sixth edition, 2017, McGraw Hill Education. 3. Agile software construction, John hunt, First edition, 2005, springer.
e-Resources and other Digital Material
1. https://agilesoftwaredevelopment.com

Parallel Computing

Course Code	19CS4701D	Year	IV	Semester	I
Course Category	Program Elective - IV	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Operating Systems, Computer Organization
Continuous Internal Evaluation :	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the concepts of Parallel computing/programming	L2
CO2	Apply various Distributed programming Algorithms for a given Program.	L3
CO3	Apply various Shared Memory Programming methods with Pthreads/OpenMP on a given matrix/program.	L3
CO4	Apply parallelism and searching for a given tree structure.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

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

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Parallel Computing**: Need of Performance, Building Parallel Systems, Why to Write Parallel Programs? How to Write Parallel Programs? Approach : Concurrent, Parallel, Distributed **Parallel Hardware and Parallel Software :** Background, Modifications to the von Neumann Model, Parallel Hardware, Parallel Software, Input and Output, Performance, Parallel Program Design and Writing and Running Parallel Programs	**CO1**
II	**Distributed Memory Programming with MPI:** Getting Started, The Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived Data types, A Parallel Sorting Algorithm**.**	**CO1,CO2**
III	**Shared Memory Programming with Pthreads** : Processes, Threads and Pthreads, Hello, World program ,Matrix-Vector Multiplication, Critical Sections Busy-Waiting, Mutexes, Producer-Consumer Synchronization and Semaphores, Barriers and Condition Variables, Read-Write Locks, Caches, Cache-Coherence, and False Sharing and Thread-Safety	**CO1,CO3**
IV	**Shared Memory Programming with Open MP :** Introduction to Open MP, The Trapezoidal Rule, Scope of Variables, The Reduction Clause, The Parallel For Directive, More About Loops in Open MP: Sorting, Scheduling Loops, Producers and Consumers, Caches, Cache-Coherence, and False Sharing and Thread-Safety	**CO1,CO3**
V	**Parallel Program Development and Parallel Algorithms :** Two N-Body Solvers, Tree Search and Case Studies	**CO1,CO4**

Learning Resources

Text Books

1. An Introduction to Parallel Programming, Peter S Pacheco, 2011, Elsevier India.

References

1. Parallel Programming for Multicore and Cluster Systems, Thomas Rauber, Gudula Rünger, Second Ed., Springer, 2015
2. Introduction to Parallel Computing(From Algorithms to Programming on State-of-the-Art Platforms), Roman Trobec, Boštjan Slivnik, Patricio Bulić, Borut Robič, 2018, Springer Nature Switzerland.
3. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis & Vipin Kumar, Second edition, 2004, Pearson Education

e-Resources & Other Digital Material

1. www.https://www.udemy.com/
2. https://www.coursera.org/

Program Elective-V

Big Data

Course Code	19CS4701A	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Machine Learning
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of big data	**L2**
CO2	Apply the concept of HDFS, Map reduce, Spark for storing and processing of Big data	**L3**
CO3	Apply Hive for working with Big data.	**L3**
CO4	Apply various analytics mechanisms to design a recommender system.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												1	
CO3	3								3	3				1
CO4		3				1	1							1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Meet Hadoop:** Data, Data Storage and Analysis, Querying All Your data, Beyond Batch, Comparison with Other Systems: Relational database Management Systems, Grid Computing, Volunteer Computing, A Brief History of Apache Hadoop. **Map Reduce:** A Weather Dataset: Data Format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java Map Reduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed Map Reduce Job.	**CO1,CO2**
II	**The Hadoop Distributed Filesystem:** The Design of HDFS, HDFS Concepts, The Command Line Interface, Hadoop File systems, The Java Interface, Data Flow, Parallel Copying with distcp.	**CO1,CO2**
III	**Hive:** Hive Shell, An Example, Running Hive: Configuring Hive, Hive Services, The Metastore, Comparison with Traditional Databases: Schema on Read Versus Schema on write, Updates, transactions, and Indexes, SQL-on Hadoop Alternatives, **HiveQL:** Data Types, Operators and Functions and Tables: managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables and Dropping Tables.	**CO1,CO3**
IV	**Spark:** Installing Spark, An Example: Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables: Broadcast Variables, Accumulators, Anatomy of a Spark Job: Run: Job Submission, DAG Construction, Task Scheduling, Task Execution	**CO1,CO2**
V	**Use case Study:** Recommendation Systems: Introduction, A Model for Recommendation Systems, Collaborative Filtering System and Content Based Recommendations.	**CO1,CO4**

Learning Resources
Text Book
1. Hadoop: The Definitive Guide, Tom White, Fourth Edition, 2015, O"Reilly. 2. Big Data Analytics, Radha Shankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley
References
1. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers 2. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015, Wiley.

3. Big data analytics with R and Hadoop, Vignesh Prajapati, First Edition, 2013, SPD.
4. Spark: The Definitive Guide :Big Data Processing Made simple, Bill Chambers and Matei Zaharia, First Edition, 2018, O‟Reilly

e-Resources and other Digital Material

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://www.coursera.org/specializations/big-data
3. https://www.edx.org/course/big-data-fundamentals

Cyber Forensics

Course Code	19CS4801B	Year	IV	Semester	II
Course Category	Program Elective - V	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	-
Continuous Internal Evaluation :	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand Fundamentals of Cyber Forensics, Tools and Techniques	L2
CO2	Apply digital techniques for processing of crime evidence and incident scenes for a given scenario	L3
CO3	Apply various Disk management techniques/File Structures for Examining and investigating a given case	L3
CO4	Apply various digital forensics tools and methods on various platforms for a given scenario	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3							**1**						
CO 2	3												1	
CO 3	2			**1**					1	1			1	
CO 4	3				**1**									2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Understanding the Digital Forensics Profession and Investigations:** An Overview of Digital Forensics, Preparing for Digital Investigations, Maintaining Professional Conduct, Preparing a Digital Forensics Investigation, Conducting an Investigation. **Data Acquisition:** Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisitions, Performing RAID Data Acquisitions, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools.	**CO1**
II	**Processing Crime and Incident Scenes**: Identifying Digital Evidence, Collecting Evidence in Private-Sector Incident Scenes, Processing Law Enforcement Crime Scenes, Preparing for a Search, Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the Scene, Storing Digital Evidence, Obtaining a Digital Hash	**CO1,CO2**
III	**Working with Windows and CLI Systems:** Understanding File Systems, Exploring Microsoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption, Understanding the Windows Registry, Understanding Microsoft Startup Tasks, Understanding Virtual Machines	**CO1,CO3**
IV	**Current Digital Forensics Tools:** Evaluating Digital Forensics Tool Needs, Digital Forensics Software Tools, Digital Forensics Hardware Tools, Validating and Testing Forensics Software **Digital Forensics Analysis and Validation:** Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques. **Network Forensics:** Network Forensics Overview: The Need for Established Procedures, Securing a Network, Developing Procedures for Network Forensics, Investigating Virtual Networks, Examining the Honeynet Project.	**CO1,CO4**
V	**E-mail and Social Media Investigations**: Exploring the Role of E-mail in Investigations, Exploring the Roles of the Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Applying Digital Forensics Methods to Social Media Communications. **Mobile Device Forensics and the Internet of Anything:** Understanding Mobile Device Forensics, Understanding Acquisition Procedures for Mobile Devices, Understanding Forensics in the Internet of Anything. **Cloud Forensics:** Basic Concepts of Cloud Forensics, Conducting a Cloud Investigation, Tools for Cloud Forensics	**CO1,CO4**

Learning Resources

Text Books

1. Guide to Computer Forensics and Investigations, Bill Nelson, Amelia Phillips, Christopher Steuart, Sixth edition, 2020, Cengage Learning India Pvt. Ltd.

References

1 Investigating the Cyber Breach: The Digital Forensics Guide for the Network Engineer, Lakhani Joseph, Muniz, Aamir, First edition, 2018, Pearson Education.

2 Digital Forensics Basics: A Practical Guide Using Windows OS, Nihad A. Hassan, First edition, 2019, Apress.

3 Fundamentals of Digital Forensics: Theory, Methods, and Real-Life Applications, Joakim Kävrestad, First edition, 2018, Springer International Publishing.

e-Resources & Other Digital Material

1. https://www.udemy.com/topic/computer-forensics/
2. https://www.coursera.org/professional-certificates/ibm-cybersecurity-analyst

SOFTWARE TESTING METHODOLOGIES

Course Code	19CS4702C	**Year**	IV	**Semester**	I
Course Category	Professional Elective-V	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Software Engineering, Software Requirements Management
Continuous Inter Evaluation :	30	**Semester End Evaluatio**	70	**Total Marks:**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		
CO1	Understand fundamentals of software testing strategies and principles.	L2
CO2	Apply various software testing strategies to the projects.	L3
CO3	Apply concepts and principles of test suite management for efficient test case generation	L3
CO4	Analyze and choose suitable modern software testing tools for a given project	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								3	3			1	
CO3	3													
CO4		3			1								1	

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction:** Software testing definition, evaluation of software testing, software testing myths and facts, goals and model of software testing, software testing terminology, software testing life cycle, testing methodology.	**CO1**
II	**Dynamic testing:** Black-Box testing: Boundary value analysis, equivalence class testing. White-box testing: Introduction, basic path testing, loop testing. **Static testing:** inspections, structured walkthroughs, Technical Reviews	**CO1, CO2**
III	**Validation activities:** Module validation testing, integration testing, function testing, system testing, accepting testing. **Regression Testing:** Objectives of regression testing, regression testing types, regression testing techniques.	**CO1** **CO2**
IV	**Test management:** Test organization, structure of testing group, test planning, test design and test specification. **Efficient test suite management:** Introduction, minimizing the test suite and its benefits, defining test suite minimization problem, test suite prioritization, types of test case prioritization, prioritization techniques.	**CO1** **CO3**
V	**Automation and Testing Tools:** need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools. Testing Object Oriented Software: basics, Object oriented testing	**CO1, CO4**

Learning Resources
Text Books
1. Software Testing: Principles and Practices, Naresh Chauhan, Second edition, Oxford.
References
1. Software testing techniques, Baris Beizer, Second edition, 2009, International Thomson computer press, DreamTech. 2. Foundations of Software testing, Aditya P Mathur, Second edition, 2013, Pearson.
e-Resources and other Digital Material
1. https://nptel.ac.in/courses/106/105/106105150/ 2. http://www.nptelvideos.in/2012/11/software-engineering.html

Fundamentals of Block Chain Technology

Course Code	19CS4701D	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Database Management System, Distributed Systems, Cryptography
Continuous Intern Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		
CO1	Understand the basic principles of block chain technology	**L2**
CO2	Apply cryptographic functions along with their implementation strategies.	**L3**
CO3	Analyze the various protocols and mining techniques in Block chain.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	3													
CO 2	3												1	
CO 3	2								2	2				2

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Block chain Fundamentals:** Tracing Block chain‟s Origin, Revolutionizing the Traditional Business Network, How Block chain Works, What Makes a Block chain Suitable for Business? **Introduction to Cryptography:** Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree.	**CO1**
II	**Digital Signatures:** Elliptic Curve Digital Signature Algorithm (ECDSA), Public Keys as Identities, A Simple Crypto currency.	**CO1,CO2**
III	Centralization vs. Decentralization, Distributed Consensus, Consensus without identity using a block chain, Incentives and proof of work. **Mechanics of Bit coin**: Bit coin transactions, Bit coin Scripts, Applications of Bit coin scripts, Bit coin blocks, The Bit coin network.	**CO1,CO3**
IV	**Storage of and Usage of Bit coins:** Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.	**CO1,CO3**
V	**Bit coin Mining:** The Task of Bit coin miners, Mining Hardware, Mining pools, Mining incentives and strategies. **Bit coin and Anonymity:** Anonymity Basics, Mixing, Zero coin and Zero cash	**CO3**
Learning Resources		
Text Books		
1. Block Chain for dummies, Manav Gupta, Second IBM Limited Edition, 2018, John Wiley & Sons. 2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, 2016.		
References		
1. Blockchain: Blueprint for a New Economy, Melanie Swan, First edition, 2015, O'Reilly Media. 2. Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, Mastering, Second edition, 2017, O'Reilly Media.		
e-Resources and other Digital Material		
1. https://nptel.ac.in/courses/106/104/106104220/ 2. https://nptel.ac.in/courses/106/105/106105184/		

Mobile Application Development Lab

Course Code	19CS3751	**Year**	IV	**Semester**	I
Course Category	**Program Core Lab**	**Branch**	CSE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Java, DBMS, Advanced Java and Web Technologies
Continuous Internal Evaluation :	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply the basic of android to develop android applications	**L3**
CO2	Develop various applications as an individual or team	
CO3	Develop an effective report based on various programs implemented	
CO4	Apply technical knowledge for a given problem and express with an effective oral communication	**L3**
CO5	Analyze outputs generated using android application	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2	1	1
CO2					3				3					
CO3										3				
CO4	3									3				
CO5		3												

Course Content		
Expt. No.1	Build mobile application based on the concept activity life cycle with Custom Toast.	**CO1, CO2, CO3, CO4, CO5**
Expt. No.2	Build mobile application using different layouts(use any 3 layouts)	**CO1, CO2, CO3, CO4, CO5**
Expt. No.3	Build mobile application using different dialogs(use any 2 dialogs)	**CO1, CO2, CO3, CO4, CO5**
Expt. No.4	Build mobile application using Menus and Action bar	**CO1, CO2, CO3, CO4, CO5**
Expt. No.5	Build mobile application to switch from one activity to another using Intent.	**CO1, CO2, CO3, CO4, CO5**
Expt. No.6	Build mobile application to demonstrate Dynamic Fragments	**CO1, CO2, CO3, CO4, CO5**
Expt. No.7	Build mobile application for CMS (Content Management System) with CURD operations	**CO1, CO2, CO3, CO4, CO5**
Expt. No.8	Build mobile application for Online Enquiry System with CURD operations	**CO1, CO2, CO3, CO4, CO5**
Expt. No.9	Build mobile application (case study) based on the choice of student/faculty	**CO1, CO2, CO3, CO4, CO5**

Learning Resources

Reference Books

1. Professional Android, Reto Meier, Ian Lake, Fourth Edition, 2018, Wrox
2. Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths, David Griffiths, 2015, O'Reilly

***Note: The above experiments are listed in generic format. Course Coordinators are advised to implement the above generic experiments using emerging technologies like: Flutter / Android Studio / .net core 5 …**

Natural Language Processing

Course Code	19CS4801A	Year	IV	Semester	II
Course Category	Program Elective-VI	Branch	CSE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Machine Learning
Continuous Internal Evaluation :	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamental concepts of natural language processing/generation.	**L2**
CO2	Apply basic evaluating language models for the probability of the test set.	**L3**
CO3	Apply techniques for extracting limited forms of semantic content from texts.	**L3**
CO4	Analyze parsing algorithms through the use of context-free grammars.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												1	
CO3	3					1							1	
CO4		3							3	3				1

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Regular Expressions, Text Normalization, Edit Distance-** Regular Expression, Words, Corpora, Text Normalization, Minimum Edit Distance. **N-Gram Language Models -** NGrams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, The web and stupid Backoff, Advanced Perplexity‟s Relation to Entropy.	**CO1, CO2**
II	**Labeling for Parts of Speech-** English Word Classes, Part-of-Speech Tagging, Named Entities and Named Entity Tagging, HMM Part-of-Speech Tagging, Conditional Random Fields (CRFs), Evaluation of Named Entity Recognition.	**CO1, CO2**
III	**Formal Grammars of English-** Constituency, Context-Free Grammars, Some Grammar Rules for English, Treebanks, Grammar Equivalence and Normal Form, Lexicalized Grammars. **Syntactic Parsing-** Ambiguity, CKY Parsing: A Dynamic Programming Approach, Span-Based Neural Constituency Parsing, Evaluating Parsers, Partial Parsing, CCG Parsing.	**CO1, CO4**
IV	**Dependency Parsing-** Dependency Relations, Dependency Formalisms, Dependency Treebanks, Transition-Based Dependency Parsing, Graph-Based Dependency Parsing, Evaluation. **Representation of Sentence Meaning-** Computational Desiderata for Representations, Model-Theoretic Semantics, First-Order Logic, Event and State Representations, Description Logics.	**CO1, CO3**
V	**Semantic Parsing, Information Extraction-** Relation Extraction, Relation Extraction Algorithms, Extracting Times, Extracting Events and their Times, Template Filling. **Lexicons for Sentiment, Affect and Connotation-** Defining Emotion, Available Sentiment and Affect Lexicons, Creating Affect Lexicons by Human Labeling, Semi-supervised Induction of Affect Lexicons, Supervised Learning of Word Sentiment, Using Lexicons for Sentiment Recognition, Other tasks: Personality, Affect Recognition, Lexicon-based methods for Entity-Centric Affect.	**CO1, CO3**

Learning Resources

Text Books

1. Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Daniel Jurafsky and James H Martin, Third Edition, 2020.

References

1. Natural Language Processing Recipes, Akshay Kulkarni, AdarshaShivananda, 2019, Apress.
2. Applied Text Analysis with Python, Benjamin Bengfort, Tony Ojeda, Rebecca Bilbro, 2018, O'Reilly Media.
3. Natural Language Processing: An information Access Perspective by Kavi Narayana Murthy, 2006, EssEss Publications.
4. Statistical Language Learning, Charniack, Eugene, 1993, MIT Press.

e-Resources and other Digital Material

1. https://web.stanford.edu/~jurafsky/slp3/
2. https://swayam.gov.in/nd1_noc19_cs56/preview
3. https://online.stanford.edu/courses/xcs224n-natural-language-processing-deep-learning
4. https://www.coursera.org/specializations/natural-language-processing

ADVANCES IN INTERNET OF THINGS

Course Code	19CS4801B	**Year**	IV	**Semester**	II
Course Category	**Program Elective-VI**	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Internet of Things
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basic concepts of IoT - Applications, Architectures	**L2**
CO2	Apply data and analytics for IoT	**L3**
CO3	Apply IoT in the areas of Manufacturing, Agriculture and develop applications for the benefit of society	**L3**
CO4	Analyze various smart components and architectures to develop smart cities and transportation applications	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2	2													
CO3		3							3	3			1	1
CO4		2	1			1	1						1	1

Course Content		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges. **IoT Network Architecture and Design:** Drivers Behind New Network Architectures, Comparing IoT Architectures , A Simplified IoT Architecture, The Core IoT Functional Stack , IoT Data Management and Compute Stack	**CO1**
II	**Data and Analytics for IoT:** An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics	**CO2**
III	**IoT in Industry:** Manufacturing - An Introduction to Connected Manufacturing, An Architecture for the Connected Factory. **Smart Farming and Smart Agriculture:** Climate condition monitoring and automate system, IoT Based Smart Irrigation Monitoring and Controlling System, Monitoring and Discrimination of Plant Disease and Insect Pests based on agricultural IoT	**CO3**
IV	**IoT for Smart and Connected Cities:** An IoT Strategy for Smarter Cities, Smart City IoT Architecture, **Smart City Use-Case Examples**	**CO1, CO4**
V	**IoT for Transportation:** Transportation Challenges, IoT Use Cases for Transportation, An IoT Architecture for Transportation.	**CO1, CO4**

Learning Resources
Text Books
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 2017, Pearson Press. 2. AI, Edge and IoT-based Smart Agriculture, Ajith Abraham Sujata Dash Joel J.P.C. Rodrigues Biswaranjan Acharya Subhendu K. Pani, First Edition, 2021, Academic Press
Reference Books
1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases. Pethuru Raj and Anupama C. Raman, 2017, CRC Press. 2. "Internet of Things (A Hands-onApproach)", Vijay Madisetti and ArshdeepBahga, 1/e, VPT, 2014.
e-Resources and other Digital Material
1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html.

Secure Software Engineering

Course Code	19CS4701C	**Year**	IV	**Semester**	II
Course Category	Program Elective-VI	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Software Engineering, Information Securt
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the fundamentals of secure software techniques in software development	**L2**
CO2	Apply secure software requirement and architecture models in software development.	**L3**
CO3	Apply the Concepts of System Security and Complexity in Software Development Process.	**L3**
CO4	Apply suitable framework for providing security to a project.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								2	2				
CO3	3												1	
CO4		3												2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Security a software Issue:** Introduction, the problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of Detecting Software Security **What Makes Software Secure** : Properties of Secure Software, Influencing the security properties of software, Asserting and specifying the desired security properties?	**CO1**
II	**Requirements Engineering for secure software** : Introduction, the SQUARE process Model, Requirements elicitation and prioritization.	**CO1, CO2**
III	**Secure Software Architecture and Design:** Introduction, software security practices for architecture and design: architectural risk analysis, software security knowledge for architecture and design: security principles, security guidelines and attack patterns **Secure coding and Testing:** Code analysis, Software Security testing, Security testing considerations throughput the SDLC.	**CO1, CO2**
IV	**Security and Complexity:** System Assembly Challenges: Introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security	**CO1, CO3**
V	**Governance and Managing for More Secure Software:** Introduction, Governance and security, Adopting an enterprise software security framework, How much security is enough?, Security and project management, Maturity of Practice	**CO1, CO4**

Learning Recourses

Text Books

1. Software Security Engineering, Julia H. Allen, 2009, Pearson Education.

References

1. Developing Secure Software, Jason Grembi, 2009, Cengage Learning.
2. Software Security, Richard Sinn, 2009, Cengage Learning

e-Resources and other Digital Material

1. https://nptel.ac.in/courses/106/105/106105150/
2. http://www.nptelvideos.in/2012/11/software-engineering.html

Big Data

Course Code	19CS4701D	**Year**	IV	**Semester**	II
Course Category	**Program Elective-VI**	**Branch**	CSE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Data mining
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of big data	**L2**
CO2	Apply the concept of HDFS, Map reduce, Spark for storing and processing of Big data	**L3**
CO3	Apply Hive for working with Big data and formulate an efficient report	**L3**
CO4	Apply various analytics mechanisms to design a recommender system.	**L3**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													
CO3	3								3	3				
CO4		3												

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Meet Hadoop:** Data, Data Storage and Analysis, Querying All Your data, Beyond Batch, Comparison with Other Systems: Relational database Management Systems, Grid Computing, Volunteer Computing, A Brief History of Apache Hadoop. **Map Reduce:** A Weather Dataset: Data Format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java Map Reduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed Map Reduce Job.	**CO1,CO2**
II	**The Hadoop Distributed Filesystem:** The Design of HDFS, HDFS Concepts, The Command Line Interface, Hadoop File systems, The Java Interface, Data Flow, Parallel Copying with distcp.	**CO1,CO2**
III	**Hive:** Hive Shell, An Example, Running Hive: Configuring Hive, Hive Services, The Metastore, Comparison with Traditional Databases: Schema on Read Versus Schema on write, Updates, transactions, and Indexes, SQL-on Hadoop Alternatives, **HiveQL:** Data Types, Operators and Functions and Tables: managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables and Dropping Tables.	**CO1,CO3**
IV	**Spark:** Installing Spark, An Example: Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables: Broadcast Variables, Accumulators, Anatomy of a Spark Job: Run: Job Submission, DAG Construction, Task Scheduling, Task Execution.	**CO1,CO2**
V	**Use case Study:** Recommendation Systems: Introduction, A Model for Recommendation Systems, Collaborative Filtering System and Content Based Recommendations.	**CO1,CO4**

Learning Resources
Text Book
1. Hadoop: The Definitive Guide, Tom White, Fourth Edition, 2015, O‘‘Reilly. 2. Big Data Analytics, Radha Shankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley
References
1. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers 2. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015, Wiley.

3. Big data analytics with R and Hadoop, Vignesh Prajapati, First Edition, 2013, SPD.
4. Spark: The Definitive Guide :Big Data Processing Made simple, Bill Chambers and Matei Zaharia, First Edition, 2018, O‟Reilly

e-Resources and other Digital Material

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://www.coursera.org/specializations/big-data
3. https://www.edx.org/course/big-data-fundamentals