Bapatla Engineering College

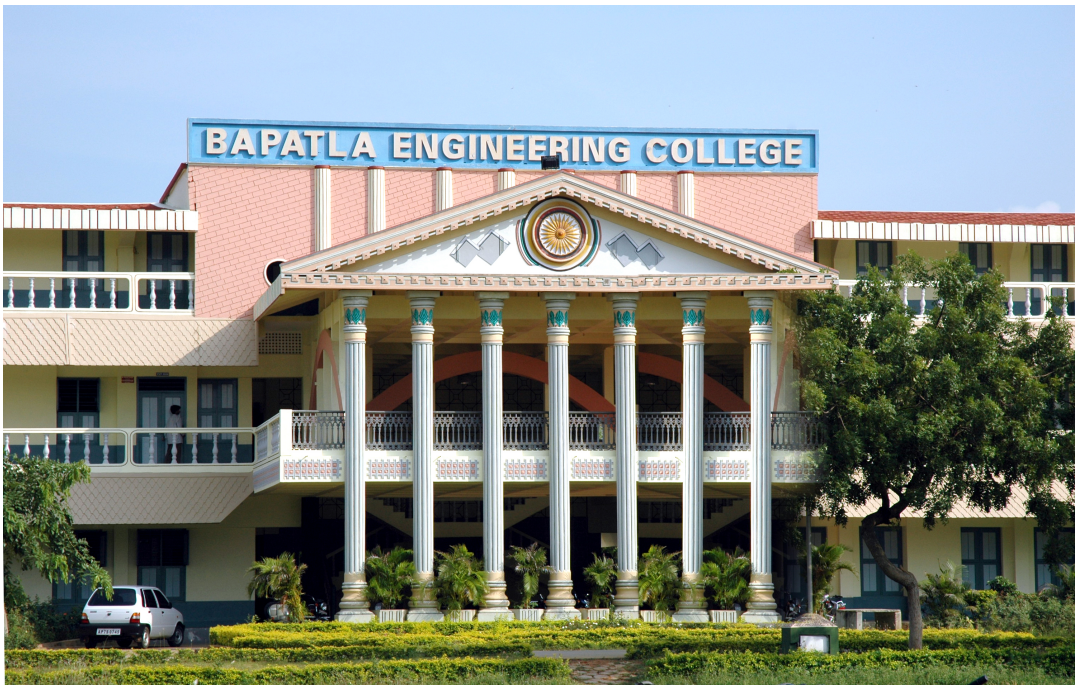
(Autonomous)

B.Tech.

Information Technology

Curriculum Effective from A.Y. 2020-21

(R20 Regulations)



Bapatla Engineering College :: Bapatla

(Autonomous under Acharya Nagarjuna University)
(Sponsored by Bapatla Education Society)
BAPATLA - 522102 Guntur District, A.P., INDIA
www.becbapatla.ac.in

Contents

Vision of the College

To build centers of excellence, impart high quality education and instill high standards of ethics and professionalism through strategic efforts of our dedicated staff, which allows the college to effectively adapt to the ever changing aspects of education.

To empower the faculty and students with the knowledge, skills and innovative thinking to facilitate discovery in numerous existing and yet to be discovered fields of engineering, technology and interdisciplinary endeavors.

Mission of the College

Our Mission is to impart the quality education at par with global standards to the students from all over India and in particular those from the local and rural areas.

We continuously try to maintain high standards so as to make them technologically competent and ethically strong individuals who shall be able to improve the quality of life and economy of our country.

Vision of the Department

Our vision is to empower our students with the skills and knowledge necessary to meet the challenges of the 21st century, driving sustainable socio-economic development through innovative solutions and responsible use of technology.

Mission of the Department

1. Catering to the needs of students by providing good infrastructure and by imparting skills relevant to the IT industry.
2. To motivate students and faculty members towards self-learning to acquire knowledge about emerging technologies in the IT industry.
3. Promoting research that leads to innovative solutions using cutting-edge technologies in IT domain for the benefit of the society.
4. To inculcate team spirit, leadership qualities and ethics among the students and faculty.

Program Educational Objectives

The students graduated in Information Technology will be able to

PEO1: Become successful and ethical professionals in IT and ITES (Information Technology Enabled Services) industries contributing to societal progress.

PEO2: Engage in lifelong learning, adapting to changing technological scenarios.

PEO3: Communicate and work effectively in diverse teams and exhibit leadership qualities.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

B.Tech. in Information Technology graduates will be able to:

PSO1 **Domain Knowledge:** Acquire knowledge of hardware functionality, design and development of software components required to process the information.

PSO2 **Problem Solving Skills:** Analyze data, Identify required data structures, design suitable algorithms, develop, operate and maintain software for real world problems.

PSO3 **Paradigm Shifts:** Understand the progressive changes in computing, possess knowledge of context aware applicability of paradigms.

B.Tech Regular Four Year Degree Programme

(For the batches admitted from the Academic Year 2020 - 21)

Preliminary Definitions and Nomenclature

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Acharya Nagarjuna University, Guntur).

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., one odd and one even.

Branch: Means specialization in a program like B.Tech degree program in Civil Engineering, B.Tech degree program in Computer Science and Engineering etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., are considered to be foundational in nature.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit-based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Certificate Course: It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student overall the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Detention in a Course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal examinations and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means Bapatla Engineering College, Bapatla, unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOCs inculcate the habit of self-learning. MOOCs would be additional choices in all the elective group courses.

Minor: Minors are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research-based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech programs offered by Institute, are designated as "BEC Regulations – R20" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 16 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioural.

University: Means Acharya Nagarjuna University, Guntur.

Academic Regulations

(Regulations for Four Year Bachelor of Technology (B.Tech) Degree programme for the Batches admitted from the academic year 2020-21)

1. **Award of B.Tech. Degree**

   A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

   i. Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility, this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation. A lateral entry student pursues a course of study for not less than three academic years and in not more than six academic years

   ii. Registers for 160 credits and secures all 160 credits. However, a lateral entry student registers for 121 credits and secures all the 121 credits from III semester to VIII semester of Regular B. Tech. program.

   iii. The student will be eligible to get Under graduate degree with honours or additional minor engineering if he/she completes an additional 20 credits

   iv. A student will be permitted to register either for Honours degree or additional minor engineering but not both.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. A lateral entry student should complete the course within six academic years from the year of their admission, failing which his/her admission in B.Tech course stands cancelled

3. **Courses of study**

   The following courses of study are offered at present as specializations for the B. Tech. course

S.No.	Title of the UG Programme	Abbreviation
1.	Civil Engineering	CE
2.	Computer Science & Engineering	CS
3.	Electrical & Electronics Engineering	EE
4.	Electronics & Communication Engineering	EC
5.	Electronics & Instrumentation Engineering	EI
6.	Information Technology	IT
7.	Mechanical Engineering	ME
8.	Cyber Security	CB
9.	Data Science	DS

4. **Credits:**

i. *Credit*: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture) or two hours of practical work/field work per week.

ii. *Academic Year*: Two consecutive (one odd + one even) semesters constitute one academic year.

iii. *Choice Based Credit System (CBCS)*: The CBCS provides choice for students to select from the prescribed courses.

iv. Each course in a semester is assigned certain number of credits based on following

Course Type	Hours / Week	Credits
Theory	3	3
Tutorial	1	1
Practical	3	1.5
Internship (At the end of IV & VI evaluated in V & VII resp.)	-	1.5/3.0
Project work	-	12

5. **Course Structure**

Every course of the B.Tech program will be placed in one of the 8 categories with suggested credits as listed below.

S.No.	Category	Category Description	Abbreviated Category	Credits
1	Humanities and social science	Humanities and social science including Management courses	HS	10.5
2	Basic Sciences	Basic Science courses	BS	21
3	Engineering Science courses	Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc.	ES	24
4	Professional core	Professional core Courses	PC	51
5	Open Electives	Open Elective Courses- from other technical / emerging and job oriented	OE	12
6	Professional Courses	Professional Elective Courses relevant to chosen specialization / branch	PE	18
7	Project Work	Project Work, Seminar, Internship in industry elsewhere	PW	16.5
8	Mandatory courses	Environmental Studies, Induction training, Universal human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge (Non-Credit)	MC	0
9	Skill Oriented Courses	Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry	SC	10
Total Credits				160

6. Weightage for course evaluation

6.1 Course Pattern

- The entire course of study is for four academic years. Semester pattern shall be followed in all years.
- A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
- When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

6.2 Evaluation Process

- The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded.
- The performance of a student in each course is assessed with alternate assessment methods, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.
- The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Internships carried out after IV Semester & VI Semester shall be evaluated for 100 marks each and the Internship along with Project Work carried out in VIII Semester shall be evaluated for 100 marks. For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For project work, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination / Viva-Voce. The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

Nature of the course	**CIE**	**SEE**
Theory subjects	30	70
Drawing	30	70
Practical	30	70
Summer / Industrial / Research Internship	–	100
Project work	30	70

6.3 **Continuous Internal Evaluation (CIE) in Theory subjects:**

6.3.1 In each Semester there shall be two Term examinations and some **Alternate Assessment Tools (AAT)** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tools with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course. It will be reviewed and approved by the Department Committee.

The Term Examination is conducted in the regular mode according to a schedule which will be common for a particular year of study. The maximum weightage for Term Examinations, AATs and the calculation of marks for CIE in a theory course is given in the following table.

Particulars	Term Exams (Max. 20 marks)	AAT (Max. 10 marks)
Better Performed exam	75% of marks obtained	Continuous assessment by teacher as per the predetermined course delivery & assessment plan. (Minimum two and maximum four assessments) AAT marks shall be considered based on average of all tests conducted.
Other exam	25% of marks obtained	

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that course and eligible to write the SEE of that course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.2 **Semester End Examination (SEE) in Theory and Design courses:**

a) For each theory or design course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 70 marks, except where stated otherwise in the detailed Scheme of Instruction. Question paper setting shall be set by the teacher or teachers together in a multi section courses and are to be verified as described in policy document.

b) A minimum of 25 (Approx. 35%) marks are to be secured exclusively in the Semester End Examination (SEE) of theory or design course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.3 **Continuous Internal Evaluation (CIE) in laboratory courses:**

The evaluation for Laboratory course is based on CIE and SEE. The CIE for 30 marks comprises of 15 marks for day to day laboratory work, 5 marks for record submission and 10 marks for a laboratory examination at the end of the semester. In any semester, a minimum of 90 percent of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.
A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that lab course and eligible to write the SEE of that lab course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.4 **Semester End Examination (SEE) in laboratory courses:**

a) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the Principal and the duration of the exam shall be for three hours. The SEE is for 70 marks which include 15 marks for write up, 35 marks for lab experiment/exercise, 15 marks for Viva-voce and 5 marks for general impression.

b) A minimum of 25 (approx. 35%) marks are to be secured exclusively in the Semester End Examination (SEE) of laboratory course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.5 **Evaluation of Summer Internship and Industrial/Research Internship:**

a) Summer Internship at the end of IV semester and Industrial/Research Internship at the end of VI carried out in industry are to be evaluated in V & VII semesters respectively based on the report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.

b) A minimum of 40 (40%) marks are to be secured exclusively to be declared as passed and securing the credits in the internships.

6.3.6 **Evaluation of the Project**

a) In case of the Project work, the evaluation shall be based on CIE and SEE. The CIE for 50 marks consists of a minimum of two Seminars / presentations for 20 marks and the Project Report submitted at the end of the semester which is evaluated for 30 marks.

b) A minimum of 25 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as passed in the Project Work and eligible to write the SEE in the Project Work.

c) SEE shall be evaluated in the form of a Viva- voce and the demonstration of the thesis work for 100 marks. Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner to be appointed by the Principal.

d) A minimum of 40 (40%) marks shall be obtained in SEE exclusively in order to be declared as passed in the Project and for the award of the grade.

NOTE : A student who is absent for any Test / Exam / Seminar / Presentation as a part of Continuous Internal Evaluation (CIE), for any reason whatsoever, shall be deemed to have scored zero marks in the respective component and no provision for make-up shall be provided.

6.4 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the mandatory course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

6.5 **Course Repetition (Repeater course)**

The students not qualified to write SEE in a course may register for the repeater courses through course repetition and summer semester. The students have to apply to the Principal through the respective HOD by paying prescribed fees.

Course repetition: A student can take up a maximum of two theory courses in a semester immediately after the semester end examinations of that particular semester in accordance with the guidelines recommended by the Academic Council. The students who are not taking regular semester courses may additionally register for one more theory course.

Summer semester: Further the students can register maximum three (theory + lab courses together) courses in the summer semester. Summer semester courses shall be of both even &

odd semesters. Summer semester shall be conducted immediately after completion of even semester end examinations.

The HODs concerned have to allot a teacher related to that course to conduct class work. The minimum number of periods to be conducted should not be less than 75% of the total prescribed periods for that course. The classes will be conducted in the vacation period or in the weekends or in the afternoons as decided by the HOD concerned. Teacher has to evaluate the student for his performance in CIE as per the autonomous norms and the qualified students should appear for a semester end examination. The pass criteria in both CIE & SEE should be as per autonomous norms.

The documents for monitoring the candidates registered for course repetition are available with the Heads of the Departments and Exam Section.

6.6 There shall be five Professional Elective Courses from V Semester to VII and for each elective there shall be choices such that the student shall choose a course from the list of choice courses offered by the department for that particular elective.

6.7 There shall be four Open Electives/ Job Oriented Courses common to all disciplines from V Semester to VII, where in the students shall choose the electives offered by various departments including his/her own department in such a manner that he/she has not studied the same course in any form during the Programme.

The students shall be permitted to pursue up to a maximum of two elective courses (either Professional Elective Courses in clause 6.6 or Open Electives/ Job Oriented Courses in clause 6.7) under MOOCs (Massive Open Online Courses) offered by NPTEL and other reputed organizations as notified by the Department during the semester. Each of the Courses must be of minimum 8 weeks in duration. The student has to acquire a certificate for the concerned course from the agency during the semester only in order to earn the credits for that course.

6.8 There shall be a mandatory **induction program** for three weeks before the commencement of first semester.

6.9 **Minor in a discipline** (Minor degree/programme) concept is introduced in the curriculum for all conventional B.Tech programmes in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B.Tech. programme.

a. i) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

ii) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

b. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

c. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BOS.

d. There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on

expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

e. The concerned BOS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.

f. A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

g. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

h. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BOS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

i. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

j. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

k. A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

l. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

m. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree

with Minors and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

n. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.
o. Minimum enrolment for a Minor course to be offered is 12.
p. Students fulfilling the stipulated criterion can register for a Minor by paying a prescribed registration fee.

6.10 **Honors degree in a discipline:**

Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

a. A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2 semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.
b. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
c. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits)
d. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8 weeks as recommended by the Board of studies.
e. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.
f. The concerned BOS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
g. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2).
h. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the BOS/academic council.
i. The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student

shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

j. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

k. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

l. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

m. Minimum enrollment for the Honors to be offered is 12.

n. Students fulfilling the stipulated criterion can register for Honors by paying a prescribed registration fee.

6.11 National Service Scheme (NSS)/Yoga is compulsory for all the Undergraduate students. The student participation shall be for a minimum period of 45 hours during the first year. Grades will be awarded as Very good, Good, Satisfactory in the mark sheet on the basis of participation, attendance, performance and behaviour. If a student gets Unsatisfactory grade, he/she has to repeat the above activity in the subsequent years along with the next year students.

6.12 Students shall undergo two summer internships each for a minimum of six weeks duration at the end of second and third years of the programme for 1.5 credits & 3 credits respectively. The organization in which the student wishes to carry out Internship need to be approved by Internal Department Committee comprising Head of Department and two senior faculty. The student shall submit a detailed technical report along with internship certificate from the Internship organization in order to obtain the prescribed credits. The student shall submit the Internship Project Report along with Certificate of Internship. The evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively. There shall be internal evaluation for 100 marks and there shall not be external evaluation. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty of the department) on the basis of the project report submitted by the student.

Completion of the internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship in the subsequent summer provided that the student doesn't pursue two summer internships in the same summer.

Community Service Project focussing on specific local issues, shall be an alternative to the six weeks of summer Internship, whenever there is any emergency and when students cannot pursue their summer internships. The Community Service Project shall be for 6 weeks in duration which includes preliminary survey for 1 week, community awareness programs for one week, community immersion program in consonance with Government agencies for 3 weeks and a community exit report (a detailed report) for one week. The community service project shall be evaluated for 100 marks by the internal departmental committee comprising Head of the Department and two senior faculty of the department. **However, the first priority shall be given to the internship.**

6.13 There shall also be a mandatory full internship in the final semester (VIII Semester) of the

Programme along with the project work. The organization in which the student wishes to carry out the Internship need to be approved by Internal Department Committee comprising Head of the Department and two senior faculty. The faculty of the respective department monitors the student internship program along with project work. At the end of the semester, the candidate shall submit a certificate of internship and a project report. The project report and presentation shall be internally evaluated for 50 marks by the departmental committee consisting of Head of the Department, Project supervisor and a senior faculty member. The Viva-Voce shall be conducted for 100 marks by a committee consisting of HOD, Project Supervisor and an External Examiner.

Completion of internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship along with project work for next six months.

6.14 There shall be five skill-oriented courses offered during III semester to VII semester. Out of the five skill courses, two shall be skill-oriented programs related to the domain and these two shall be completed in second year. Of the remaining three skill courses, one shall necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

The student can choose between a skill advanced course being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies which are duly approved by the Internal Department Committee. The credits assigned to the skill advanced course shall be awarded to the student upon producing the Course Completion Certificate from the agencies/professional bodies.

The Internal Department Committee comprising Head of Department and two senior faculty shall evaluate the grades/ marks awarded for a course by external agencies and convert to the equivalent marks/grades.

7. **Attendance Requirements:**

- A student shall be eligible to appear for semester end examinations (SEE), if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
- Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical ground duly approved by the Principal.
- Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- Further the student must obtain a minimum of 50% attendance in each subject failing which; the student shall not be permitted to write the SEE of that subject. Student has to register this subject through course repetition and satisfy the CIE qualification criteria of attendance and marks in the subsequent semesters.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
- A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

8. **Minimum Academic Requirements:**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7

8.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project, if he/she secures not less than 15 marks in CIE and 25 marks in SEE. In case of internships, project work viva – voce, he/she should secure 40% of the total marks. For mandatory courses minimum 15 marks in CIE are to be secured.

8.2 A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

One regular and two supplementary examinations of I Semester.
One regular and one supplementary examination of II Semester.
One regular examination of III semester.

Lateral Entry students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

One regular examination of III semester.

8.3 A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and four supplementary examinations of I Semester.
One regular and three supplementary examinations of II Semester.
One regular and two supplementary examinations of III Semester.
One regular and one supplementary examinations of IV Semester.
One regular examination of V Semester.

Lateral entry students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and two supplementary examinations of III Semester.
One regular and one supplementary examinations of IV Semester.
One regular examination of V Semester.

And if a student is detained for want of credits for particular academic year by sections 8.2 and 8.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester as the case may be.

8.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160

credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained. In case of lateral entry students, the number of credits is 121.

8.5 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

Lateral entry students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

9. **Course Pattern:**

(i) A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

(ii) **With–holding of Results:**

If any case of indiscipline or malpractice is pending against candidate, the result of the candidate shall be with held and he/she will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

(iii) **Grading:**

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Range in which the marks in the subject fall	Grade	Grade Points Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade “F” shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains “Ab” in end examination.

For mandatory courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

10. **Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):**

(i) The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \frac{\sum_{i=1}^{n} C_i \times GP_i}{\sum_{i=1}^{n} C_i} \tag{1}$$

where, C_i is the number of credits of the i-th subject and GP_i is the grade point scored by the student in the i-th course.

(ii) The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$SGPA = \frac{\sum_{j=1}^{m} SGPA_j \times TC_j}{\sum_{j=1}^{m} TC_j} \tag{2}$$

where $SGPA_j$ is the $SGPA$ of the j-th semester and TC_j is the total number of credits in that semester.

(iii) Both $SGPA$ and $CGPA$ shall be rounded off to 2 decimal points and reported in the transcripts.

(iv) While computing the $SGPA$, the subjects in which the student is awarded Zero grade points will also be included.

(v) Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

(vi) Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

11. **Award of Class:**

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

12. **Gap Year:**

Gap year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year

to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted by the College to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

13. **Transitory Regulations:**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, and they will be in the academic regulations into which the candidate is presently re-joining.

14. **Minimum Instruction Days:**
The minimum instruction days including exams for each semester shall be 90 days.

15. **Medium of Instruction**

The Medium of Instruction is English for all courses, laboratories, internal and external examinations and project reports.

16. **Rules of Discipline**

(i) Use of mobile phones with camera, in the campus is strictly prohibited.
(ii) Students shall behave and conduct themselves in a dignified and courteous manner in the campus/Hostels.
(iii) Students shall not bring outsiders to the institution or hostels.
(iv) Students shall not steal, deface, damage or cause any loss to the institution property.
(v) Students shall not collect money either by request or coercion from others within the campus or hostels.
(vi) Students shall not resort to plagiarism of any nature/extent. Use of material, ideas, figures, code or data without appropriate acknowledgement or permission of the original source shall be treated as cases of plagiarism. Submission of material, verbatim or paraphrased, that is authored by another person or published earlier by oneself shall also be considered as cases of plagiarism.
(vii) Use of vehicles by the students inside the campus is prohibited.
(viii) Any conduct which leads to lowering of the esteem of the organization is prohibited.
(ix) Any material to be uploaded to social media sites need to be approved by Head of the Department concerned/Dean/Principal.
(x) Any student exhibiting prohibited behaviour shall be suspended from the institute. The period of suspension and punishment shall be clearly communicated to the student. The student shall lose the attendance for the suspended period

(xi) **Dress Code**

Boys : All the boy students should wear formal dresses. Wearing T-shirts and other informal dresses in the campus is strictly prohibited.

Girls : All the girl students shall wear saree / chudidhar with dupatta.

17. **Punishments for Malpractice cases – Guidelines**

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

SN	Nature of Malpractice / Improper conduct	Punishment
1	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cellphones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
2	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 course.
3	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
4	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the students involved. In case of an outsider, he will be handed over to the police and a case shall be registered against him.

SN	Nature of Malpractice / Improper conduct	Punishment
5	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
6	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
7	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeit of seat.
8	Refuses to obey the orders of the Chief Superintendent /Asst. Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses of that semester / year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case shall be registered against them.

SN	Nature of Malpractice / Improper conduct	Punishment
9	Leaves the exam hall taking away answer script or intentionally tears up the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in S.No7 to S.No 9.	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case shall be registered against them.
12	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college for one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case shall be registered against him. The performance of the original student who has been impersonated, shall be cancelled in all the courses of the examination including practicals and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
13	If any malpractice is detected which is not covered in the above S.No 1 to S.No 12 items, it shall be reported to the college academic council for further action and award suitable punishment.	
14	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

18. **Additional Academic Regulations:**

18.1 Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

18.2 When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

19. **Amendments to Regulations:**
The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations and / or Syllabi, Academic schedules, Examination schedules, Examination pattern, Moderation to students, Special opportunity to complete degree beyond stipulated time and any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

20. **Discipline and Code of Conduct for Students:**
The following are some of the important rules of discipline. All students are required to be aware of and act accordingly.

a) Students must punctually attend all lectures, practicals, tutorials, assignments, tests, examinations, etc. A student whose attendance and/or progress in the various tests and examinations are not satisfactory and who does not perform the required number of assignments, tutorials and/or practicals are likely to lose their terms. Prolonged absence even on ground of ill health may also lead to loss of terms. Defaulters will not be sent up for Final /University Examinations.

b) The identity card is meant for identifying bonafide students and is used for permitting the students to participate in various activities and programs of the college. Every student must wear Identity card as long as he/she is in the college campus. It must be produced by the student whenever demanded by the member of the teaching or non-teaching staff of the college. Every student must wear his/her Identity card in the college every day. He/She must take proper care of it to avoid its misuse by other students and outsiders. In case the Identity card is lost, the matter should be immediately reported to the Principal and an application should be made for a duplicate Identity card, which will be issued on payment of charges.

c) The conduct of the students in the classes and in the premises of the college shall be such as will cause no disturbance to teachers, fellow students or other classes.

d) Every student shall wear a clean formal dress while coming to the college also when representing the college for various activities out station.

e) No Society or Association shall be formed in the College and no person should be invited in the college campus without the specific permission of the Principal.

f) No student is allowed to display any Notice/Circular/Poster/Banner in the College premises without the prior permission of the Principal.

g) Using foul languagein the college campus is prohibited. If any student is caught using foul language, disciplinary action shall be initiated against the student.

h) Use of BEC name tag or logo by the students for their caste, political, religious, personal reasons is prohibited. Further placing banners on caste, political, religious, personal reasons, promoting cinema heroes & political leaders, taking possessions and burning fire crackersin front of the collegeis strictly prohibited. If any student is involved in such activities in and around the campus, severe disciplinary action will be taken including rusticating from the college and filing a criminal case.

i) Outsiders are not permitted in the college premises without the prior permission of the Principal. College students are not allowed to bring their relatives/friends to the college premises without the permission of the principal.

j) All meetings, cultural programs, debates, elocutions etc. organized on the college premises must be held in presence of teaching staff members and with the prior permission of the Principal. The subjects of debates/elocutions must have the prior approval of the principal.

k) Conducting fresher's meet, farewell meets etc. by the students outside the campus are prohibited. If any student is involved in such activities (organizing as well as participating), severe disciplinary action will be taken including rusticating from the college.

l) Students must take proper care of the college property. Strict action will be taken against students damaging College property and will be required to compensate the damage.

m) Students should not be involved in academic offences including cheating or plagiarism in academic course work malpractices at the College/Board/University Examinations

n) Smoking is strictly prohibited in the college premises.

o) If, for any reason, the continuance of a student in the College is found detrimental to the best interest of the college, the Management may ask the student to leave the college without assigning any reasons and the decision will be final and binding on the student.

p) Playing music on Transistors, Tape-Recorders, Car Stereos, Mobile phones or any other similar gadgets with or without earphones is strictly prohibited in the college premises. Defaulters will be punished and their instrument shall be confiscated.

q) Use of Mobile phones is strictly prohibited in the academic area of the college, Defaulters will be penalized and their instrument confiscated.

r) Students who are travelling to college on personal vehicles (2/4 wheelers) need to have valid driving license issued by RTO and follow all the rules listed by RTO. Students have to park the vehicle in the parking area of the college.

s) Students must not hang around in the college premises while the classes are at work.

t) Students must not attend classes other than their own without the permission of the authority concerned.

u) Students shall do nothing inside or outside the college that will interface with the discipline of the college or tarnish the image of the college.

v) Students are not allowed to communicate any information about college matters to Press.

w) Matters not covered above will be decided at the discretion of the Principal. Acts of misbehavior, misconduct, indiscipline or violation of the Rules of Discipline mentioned above liable for one more punishments as stated below:

- Warning to the students.
- Warning to the student as well as inform the parents.
- Imposition of a fine.
- Denial of gymkhana, library, laboratory, N.C.C., N.S.S. student aid or any other facility for a specified period or for the whole Term/Year.
- Expulsion from College for a specified period
- Cancellation of Terms.
- Refusal of admission in the term or academic year.
- Cancellation of admission.
- Rustication.

21. **Anti Ragging Rules and Regulations (As per AICTE Norms)**

i. **What constitutes Ragging:** - Ragging constitutes one or more of any of the following acts:

a) any conduct by any student or students whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness a fresher or any other student;

b) indulging in rowdy or undisciplined activities by any student or students which causes or is likely to cause annoyance, hardship, physical or psychological harm or to raise fear or apprehension thereof in any fresher or any other student;

c) asking any student to do any act which such student will not in the ordinary course do and which has the effect of causing or generating a sense of shame, or torment or embarrassment so as to adversely affect the physique or psyche of such fresher or any other student;

d) any act by a senior student that prevents, disrupts or disturbs the regular academic activity of any other student or a fresher;

e) exploiting the services of a fresher or any other student for completing the academic tasks assigned to an individual or a group of students.

f) any act of financial extortion or forceful expenditure burden put on a fresher or any other student by students;

g) any act of physical abuse including all variants of it: sexual abuse, homosexual assaults, stripping, forcing obscene and lewd acts, gestures, causing bodily harm or any other danger to health or person;

h) any act or abuse by spoken words, emails, posts, public insults which would also include deriving perverted pleasure, vicarious or sadistic thrill from actively or passively participating in the discomfiture to fresher or any other student;

i) any act that affects the mental health and self-confidence of a fresher or any other student with or without an intent to derive a sadistic pleasure or showing off power, authority or superiority by a student over any fresher or any other student.

ii. Actions to be taken against students for indulging and abetting ragging in technical institutions Universities including Deemed to be University imparting technical education:-

a) The punishment to be meted out to the persons indulged in ragging has to be exemplary and justifiably harsh to act as a deterrent against recurrence of such incidents.

b) Every single incident of ragging a First Information Report (FIR) must be filed without exception by the institutional authorities with the local police authorities.

c) The Anti-Ragging Committee of the institution shall take an appropriate decision, with regard to punishment or otherwise, depending on the facts of each incident of ragging and nature and gravity of the incident of ragging.

d) Depending upon the nature and gravity of the offence as established the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:-

- Cancellation of admission
- Suspension from attending classes
- Withholding/withdrawing scholarship/fellowship and other benefits
- Debarring from appearing in any test/examination or other evaluation process
- Withholding results
- Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.
- Suspension/expulsion from the hostel

- Rustication from the institution for period ranging from 1 to 4 semesters
- Expulsion from the institution and consequent debarring from admission to any other institution.
- Collective punishment: when the persons committing or abetting the crime of ragging are not identified, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

22. **Guidelines for Remedial Classes**

a) Faculty need to identify the underperformed students in their respective subject. An underperformed student is one, whose marks less than 50% in the I Mid Term Examination and AAT 1 together. A list of such students should be prepared by the faculty soon after the I Mid Term examination is over and get it signed by the concerned HOD.

b) Faculty should conduct remedial classes for the underperforming students with an objective of improving their marks in the CIE. Minimum number of remedial classes to be taken should be 20% of the classes taken prior the I Mid Term Examination which is 6 classes. Teaching methodology is left to the faculty member, but he/she should keep the objective in mind.

c) Regular students who could not appear for the I Mid Term Examination and AAT (with genuine reason) should appear to the remedial classes with the prior permission of the HOD.

d) The entire process of conduct of remedial classes should be well documented and is subjected to academic audit.

23. **Guidelines for Make-up Test**

a) A student can appear for a Make-up Test for maximum two theory subjects of a semester to improve marks in the Continuous Internal Evaluation (CIE).

b) A student is eligible for Make-up test which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.

c) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).

d) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.

e) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).

f) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

g) The eligible students have to apply by paying a fee prescribed by the institution and submit the application along with a letter of request indicating the genuineness of his/her candidature to be eligible for the make-up test. Applications should be approved by the concerned HOD. After approval from the HOD the concerned department will conduct the make-up test and send the updated CIE marks to COE immediately.

24. **Guidelines for Internships**

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for a duration of 4 weeks and the second internship is for a duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations

which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

25. **Guidelines for Massive Open Online Courses (MOOCs)**

a) Head of the department should constitute a three member MOOC committee under his chairmanship along with two more members.

b) The committee should take the responsibility of
   - Notifying the MOOC courses twice in a semester (May and November) along with the details of portals offering the MOOC such as NPTEL/SWAYAM.
   - Checking the relevance of courses to the concerned branch.
   - Verifying the syllabus of chosen MOOC course and to ensure that it is not studied in the regular curriculum (either full or partial)

c) A student willing to take MOOCS course should apply in the prescribed format to the concerned Head of the Department at least one week prior to the commencement of the MOOC course.

d) The MOOC committee should ensure the following
   - The course duration must be minimum of 12 weeks
   - The course should contain a proctored examination for evaluation
   - The agency offering MOOCs should be a recognized and reputed one and approved by the BOS of the concerned program.

e) Students should submit the Course completion certificate with marks memos to the department MOOCs committee.

f) If the certifying authority/agency is not able to conduct the exam, then the student can show certified course progress, applied hall ticket and mail communication from the authority as proofs and can avail the extension time by one semester for submitting the course completion certificate.

g) After the student submits the MOOCs certificates, the committee should recommend 3 credits and the appropriate grade to be allocated to the student and send to the Controller of Examination.

h) If a student fails to successfully complete and acquire the certificate as per the guidelines and timelines specified by the concerned MOOCs authority, he/she has to register for that course subsequently. Unsuccessful candidates in the first attempt shall be marked as supplementary.

26. **Guidelines for Project work**

a) In R20 regulations, there is no theory or practical courses in VIII semester. An exclusive 12 credit course is included as Project Work and Internship. The student should mandatorily undergo internship as well as project work parallelly. At the end of the semester the student should submit an internship completion certificate along with a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

b) The departmental internship committee is advised to strictly adhere to the established guidelines for internships. Furthermore, it is recommended that internships for students be limited to organization / industry authorized by APSCHE / AICTE INTERNSHIP PORTAL / PUBLIC SECTOR ORGANIZATIONS. This restriction applies to both online and offline internship opportunities.

c) The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members as defined in the Process Document for project work (R20 regulation). The PWC shall adhere to the process explained in the said document.

d) Evaluation of the Project work:

- The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.
- SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.
- Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.

e) The project work committee should ensure the following, if the students are doing project work at any organization/ industry.

- The student gets placement before commencement of eighth semester and joined the organization/Industry as advance placement. The student who obtained project work opportunity in organization / Industry may also be allowed as per the recommendation of the PWC.
- The above students will be informed to apply in the specified proforma for approval to undergo for project work along with the details and consent of the organization in which he/she is seeking for doing project work. Further, the student and the parent/guardian have to submit an undertaking form to the concerned department. The PWC shall scrutinize the applications and approve.
- The list of such approved students undertaking project work in organization/ industry shall be maintained in the department by the PWC.
- The students who are undertaking the project work out side the campus have to necessarily submit the monthly attendance duly certified by the concerned authority in the organization/ industry.
- The PWC will have to maintain interaction regularly with the out-side organization/ concerned who are offering the project works.
- During the course of project work, the student has to attend the departmental internal reviews/assessment periodically as notified by the department mandatory. After the completion of the project work, the student has to submit the report and attend semester end assessment examination by paying prescribed exam fee for award of grade and credits.

- The students who are undertaking the project work outside the campus will have to complete their project work with in the stipulated period (as per Academic Calendar) along with the in-house project work students and also submit the internship completion certificate at the end of the semester.

27. **Process document for Project work**

As per the R20 regulations, students are required to do a project work in the VIII semester and submit a report. The following is the process to be followed for the project work.

a) Projects Batches and Guide allocation

- The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members. One of them shall be a senior faculty member and acts as a Project Coordinator.
- List of faculty members and their specializations, research areas will be communicated to the students. The information is disseminated via email, notice boards and display on the website. List of projects and their titles/themes should be identified and same may be communicated to all the students. Project batches are formed based on the performance of the students up to VI semester.
- Students are given an option of specifying their choices for the project titles/guides and the final allocation of guides to project batches is done based on the merit order and the choices opted by the project batches.
- It is to be ensured that no project batch should have more than 4 students.
- Not more than two batches should be allocated to each project guide.

b) Project classification and mapping with program outcomes and program specific outcomes. Projects may be broadly classified into the following categories.

- Application oriented: When the project is related to hardware, then all the components are procured and assembled to get the desired outcome. If it is related to software, then a complete working version of the application is to be created.
- Research oriented: In this category extensive review of literature is done. This aims to learn and implement new methods or procedures and validate results.
- Simulation projects: These projects may be hardware or software related. The students will create a working prototype for the same.
- The PWC should ensure that the projects are selected in such a way that the program outcomes and program specific outcomes are mapped with the themes of the project works.
- A document consisting of project titles, area of specialization, project guides should be prepared and submitted to the concerned HOD and should be put on the website. The theme of the work may be changed with the consent of the project guide.

c) Continuous monitoring mechanism and evaluation

- Project slots (24 hours per week) should be allocated as per the existing scheme and curriculum.
- A laboratory or a class room should be identified for executing the project works. It is preferred to have a separate laboratory for the purpose of conducting the project works.
- Each project batch is allowed to consult their respective guide to discuss about their Progress during the project slot.
- At the end of every month there will be an overall assessment of each project by the PWC by scheduling project reviews in association with project guides.

- The performance of the students should be evaluated in each review and should be documented.
- Department staff meeting should be conducted to discuss the performance of the students in the projects and should be documented.

d) Methodology to assess individual as well as collective Contribution/understanding of Project:

- The project guide should monitor the presence (attendance) of each student in the project work
- The project guide should ensure that the batch allocated to him is able to understand the objectives of the project. The guide should also identify the requirements (hardware and software) of the project. If a particular software or hardware is not available, same may be communicated to the HOD and may be procured based on the financial and budgetary requirements.
- Evaluation of the project is based on
- Understanding the objectives of the project.
- Day to day work done by the students (Should be documented)
- Partial/Full completion of the project
- Students presentation and demonstration
- Results and documentation
- Evaluation is intimated to the students for further improvement

e) Papers published/Awards won/conferences attended

- It is encouraged for every project batch to publish/communicate a paper in any national/ international conference/journal. The project guide may encourage the students so that the work of their batch is published as a research paper.
- Students must be given some awareness/training program for effective writing of a research paper. The research papers should be checked with anti-plagiarism software before the submission to the concerned journal or conference.
- A report should be prepared by the concerned coordinator comprising all the research papers published and should be made available in the library and soft copies must be put on the website for availability to the students.

Table 1: Distribution of Credits across Course Categories

S.No.	Category	Code	Credits		
			Proposed	APSCHE	AICTE
1	Humanities & Social Science including Management Courses	HS	10.5	10.5	12.0
2	Basic Science Courses	BS	18.0	21.0	25.0
3	Engineering Science courses	ES	22.5	24.0	24.0
4	Professional Core Courses	PC	48.0	51.0	48.0
5	Professional Elective Courses	PE	12.0	15.0	18.0
6	Open/Job Oriented Elective Courses	JO	16.5	12.0	18.0
7	Internship, Seminar & Project work	PW	16.5	16.5	15.0
8	Skill Oriented Courses	SO	16.0	10.0	0
9	Mandatory Courses	MC		non-credit	
	Total Credits		160	160	160

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., First Year, I Semester
(effective from the academic year **2023-2024**, R20 Regulations)

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT101 /MA01	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	30	70	100	3
20IT102 /CY01	BS	Engineering Chemistry	3	0	0	3	30	70	100	3
20IT103 /EE01	ES	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100	3
20ITL101 /MEL01	ES	Engineering Graphics	1	0	4	5	30	70	100	3
20ITL102 /CYL01	BS	Chemistry Lab	0	0	3	3	30	70	100	1.5
20ITL103 /EEL01	ES	Basic Electrical and Electronics Engineering Lab	0	0	3	3	30	70	100	1.5
20ITL104	ES	IT Workshop	0	0	3	3	30	70	100	1.5
20IT104 /MC01	MC	Environmental Studies	2	0	0	2	30	0	30	0
TOTAL			**11**	**1**	**13**	**25**	**240**	**490**	**730**	**16.5**
Induction Program	First Three Weeks (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)									

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination
L : Lecture **T :** Tutorial **P :** Practical **Cat:** Category

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., First Year, I Semester
(effective from the academic year **2020-2021**, R20 Regulations)

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT101 /MA01	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	30	70	100	3
20IT102 /CY01	BS	Engineering Chemistry	3	0	0	3	30	70	100	3
20IT103 /EE01	ES	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100	3
20ITL101 /MEL01	ES	Engineering Graphics	1	0	4	5	30	70	100	3
20ITL102 /CYL01	BS	Chemistry Lab	0	0	3	3	30	70	100	1.5
20ITL103 /EEL01	ES	Basic Electrical and Electronics Engineering Lab	0	0	3	3	30	70	100	1.5
20ITL104 /MEL02	ES	Workshop Practice	0	0	3	3	30	70	100	1.5
20IT104 /MC01	MC	Environmental Studies	2	0	0	2	30	0	30	0
TOTAL			**11**	**1**	**13**	**25**	**240**	**490**	**730**	**16.5**
Induction Program	First Three Weeks (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)									

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination
L : Lecture **T :** Tutorial **P :** Practical **Cat:** Category

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., First Year, II Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT201 /MA02	BS	Numerical Methods and Advanced Calculus	2	1	0	3	30	70	100	3
20IT202 /PH03	BS	Semiconductor Physics and Nanomaterials	3	0	0	3	30	70	100	3
20IT203 /EL01	HS	Communicative English	3	0	0	3	30	70	100	3
20IT204 /CS01	ES	Programming for Problem Solving	2	1	0	3	30	70	100	3
20IT205 /CC01	ES	Digital Logic Design	3	0	0	3	30	70	100	3
20IT206 /CC02	ES	Discrete Mathematics	3	0	0	3	30	70	100	3
20ITL201 /PHL02	BS	Semiconductor Physics Lab	0	0	3	3	30	70	100	1.5
20ITL202 /ELL01	HS	English Communication Skills Lab	0	0	3	3	30	70	100	1.5
20ITL203 /CSL01	ES	Programming for Problem Solving Lab	0	0	3	3	30	70	100	1.5
NSS	-	National Service Scheme	-	-	-	-	-	-	-	-
TOTAL			**16**	**2**	**12**	**30**	**270**	**630**	**900**	**22.5**

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Second Year, III Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT301	ES	Microprocessor and Microcontrollers	3	0	0	3	30	70	100	3
20IT302 /CC03	PC	Data Structures	2	1	0	3	30	70	100	3
20IT303 /CC04	PC	Object Oriented Programming	2	1	0	3	30	70	100	3
20IT304 /CC05	PC	Operating Systems	3	0	0	3	30	70	100	3
20IT305 /CC06	PC	Computer Organization	3	0	0	3	30	70	100	3
20IT306 /EL02	HS	Technical English	3	0	0	3	30	70	100	3
20ITL301 /SOC1	SO	Linux Essentials (Skill Oriented Course-I)	2	0	3	5	30	70	100	3.5
20ITL302 /CC07	PC	Data Structures Lab	0	0	3	3	30	70	100	1.5
20ITL303 /CC08	PC	Object Oriented Programming Lab	0	0	3	3	30	70	100	1.5
TOTAL			**18**	**2**	**9**	**29**	**270**	**630**	**900**	**24.5**

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Second Year, IV Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT401 /MA03	BS	Probability and Statistics	2	1	0	3	30	70	100	3
20IT402 /CC09	PC	Web Technologies	3	0	0	3	30	70	100	3
20IT403 /CC10	PC	Database Management Systems	3	0	0	3	30	70	100	3
20IT404 /CC11	PC	Design and Analysis of Algorithms	2	1	0	3	30	70	100	3
20ITL401 /SOC2	SO	Python Programming (Skill Oriented Course-II)	2	0	3	5	30	70	100	3.5
20ITL402 /CC12	PC	Web Technologies Lab	0	0	3	3	30	70	100	1.5
20ITL403 /CC13	PC	RDBMS Lab	0	0	3	3	30	70	100	1.5
20IT405 /MC02	MC	Professional Ethics & Human Values	2	0	0	2	30	0	30	0
Total			**14**	**2**	**9**	**25**	**240**	**490**	**730**	**18.5**
20ITH4 20ITM4		**Honors(Set I) / Minor(Set II) Course**	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Third Year, V Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT501 /CC14	PC	Automata Theory & Formal Languages	2	1	0	3	30	70	100	3
20IT502 /CC15	PC	Computer Networks	3	0	0	3	30	70	100	3
20IT503 /CC16	PC	Software Engineering	3	0	0	3	30	70	100	3
20IT504 /PE1	PE	Professional Elective-I	3	0	0	3	30	70	100	3
20IT505 /JO1	JO	Job Oriented Elective-I	3	0	0	3	30	70	100	3
20ITL501 /SOC3	SO	Soft Skills (Skill Oriented Course-III)	1	0	2	3	30	70	100	2
20ITL502 /CC17	PC	Software Engineering Lab	0	0	3	3	30	70	100	1.5
20ITL503 /JOL1	JO	Job Oriented Elective Lab-I	0	0	3	3	30	70	100	1.5
20ITL504 /INT01	INT	Summer Internship*	-	-	-	-	-	100	100	1.5
20IT506 /MC04	MC	Essence of Indian Traditional Knowledge	2	0	0	2	30	0	30	0
Total			**17**	**1**	**8**	**26**	**270**	**560**	**830**	**21.5**
20ITH5 20ITM5		**Honors(Set I) / Minor(Set II) Course**	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**

Professional Elective-I		**Job Oriented Elective-I (Theory and Lab)**	
1A	Artificial Intelligence	1A	Mobile Application Development
1B	Digital Image Processing	1B	Robotic Process Automation
1C	User Interface / User Experience Design	1C	Computer Animation & Game Design

∗ **To be completed after IV semester during summer vacation and is evaluated in V semester**

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Third Year, VI Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT601 /CC18	PC	Compiler Design	3	0	0	3	30	70	100	3
20IT602 /CC19	PC	Machine Learning	2	1	0	3	30	70	100	3
20IT603 /CC20	PC	Cryptography and Network Security	3	0	0	3	30	70	100	3
20IT604 /PE2	PE	Professional Elective-II	3	0	0	3	30	70	100	3
20IT605 /JO2	JO	Job Oriented Elective-II	3	0	0	3	30	70	100	3
20ITL601 /SOC4	SO	Full Stack Development (Skill Advanced Course-I)	2	0	3	5	30	70	100	3.5
20ITL602 /CC21	PC	Machine Learning Lab	0	0	3	3	30	70	100	1.5
20ITL603 /JOL2	JO	Job Oriented Elective Lab-II	0	0	3	3	30	70	100	1.5
20IT606 /MC03	MC	Indian Constitution	2	0	0	2	30	0	30	0
Total			**18**	**1**	**9**	**28**	**270**	**560**	**830**	**21.5**
20ITH6 20ITM6		**Honors(Set I) / Minor(Set II) Course**	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**

Professional Elective-II		**Job Oriented Elective-II (Theory and Lab)**	
2A	Data Warehousing & Data Mining	2A	Enterprise Programming
2B	Data Analytics	2B	Middleware Technologies
2C	Protocols for Secure Electronic Commerce	2C	Industrial IOT

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Final Year, VII Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT701 /PE3	PE	Professional Elective-III	3	0	0	3	30	70	100	3
20IT702 /PE4	PE	Professional Elective-IV	3	0	0	3	30	70	100	3
20IT703 /JO3	JO	Job Oriented Elective-III	3	0	0	3	30	70	100	3
20IT704 /O	OE	Open Elective	3	0	0	3	30	70	100	3
20IT705 /ME01	HS	Industrial Management & Entrepreneurship Development	3	0	0	3	30	70	100	3
20ITL701 /SOC5	SO	DevOps (Skill Advanced Course-II)	2	0	3	5	30	70	100	3.5
20ITL702 /JOL	JO	Job Oriented Elective Lab-III	0	0	3	3	30	70	100	1.5
20ITL703 /INT02	INT	Industrial / Research Internship	-	-	-	-	-	100	100	3
Total			**14**	**0**	**6**	**20**	**180**	**420**	**600**	**23**
20ITH7 20ITM7		**Honors(Set I) / Minor(Set II) Course**	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**

Professional Elective-III		**Professional Elective-IV**	
3A	Wireless Networks	4A	Block Chain Technologies
3B	Bigdata Analytics	4B	Distributed Systems
3C	Natural Language Processing	4C	Immersive Technologies

Job Oriented Elective-III (Theory and Lab)	
3A	Cloud Programming
3B	Cyber Security
3C	Software Testing Methodologies

SCHEME OF INSTRUCTION & EXAMINATION
for
B.Tech., Final Year, VIII Semester

Course Code	Cat.	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No of Credits
			L	T	P	Total	CIE	SEE	Total	
20IT801 /PW	PW	Project Work	0	0	20	20	30	70	100	12
Total			**0**	**0**	**20**	**20**	**30**	**70**	**100**	**12**
20ITHM1 20ITMM1	**Honors / Minor Course (MOOCS-1)**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
20ITHM2 20ITMM2	**Honors / Minor Course (MOOCS-2)**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination
L : Lecture **T :** Tutorial **P :** Practical

Table 2: Set I, Additional courses offered to B.Tech., IT students to obtain Honors degree in Information Technology

Code	Title	Prerequisites
A	Advanced Data Structures	Data Structures (20IT302/CC03)
B	Advanced Computer Architecture	Computer Organization (20IT305/CC06)
C	Graph Theory	Data Structures (20IT302/CC03)
D	Optimization Techniques	None
E	Advanced Database Management Systems	Database Management Systems (20IT403/CC10)
F	Software Project Management	Software Engineering (20IT503/CC16)
G	Storage Area Networks	Operating Systems (20IT304/CC05) and Database Management Systems (20IT403/CC10)
H	Deep Learning	Machine Learning (20IT602/CC19)

Table 3: Set II, Courses offered to non CSE and IT branch B.Tech., students for obtaining Minor degree in Information Technology

Code	Title	Prerequisites
A	Computer System Architecture	None
B	Operating Systems	None
C	Data Structures	Programming for Problem Solving (CS01)
D	Object Oriented Programming	Programming for Problem Solving(CS01)
E	Discrete Mathematics	None
F	Design and Analysis of Algorithms	Programming for Problem Solving (CS01)
G	Database Management Systems	None
H	Computer Networks	None

Table 4: Set III, Open Elective Courses. A student can choose a course which is not offered by the parent and its allied departments

Code	Offered by	Title
CM1	AIML	Artificial Intelligence
CM2	AIML	Introduction to Machine Learning
CE1	Civil	Air Pollution and Control
CE2	Civil	Remote Sensing and GIS
CB1	CB	Digital Forensics
CB2	CB	Introduction to Information Security and Cyber Laws
CS1	CSE	Database Management System
CS2	CSE	Java Programming
DS1	DS	Data Warehousing and Data Mining
DS2	DS	Social Network Analysis
EC1	ECE	Digital Image Processing
EC2	ECE	Embedded System & Design
EEE1	EEE	Non Conventional Energy Sources
EEE2	EEE	Electrical Energy Conservation and Auditing
EEE3	EEE	Industrial Electrical Systems
EI1	EI	Sensors and Signal Conditioning
IT1	IT	Cyber Security
IT2	IT	Web Technologies
ME1	MECH	Automobile Engineering
ME2	MECH	Renewable energy sources
ME3	MECH	Project Management
ME4	MECH	Entrepreneurship Development
CY1	Chemistry	Chemistry in Space technology
CY2	Chemistry	Artificial Intelligence in Sustainable Chemistry
CY3	Chemistry	Material Chemistry in daily life
EL1	English	Professional Communication
MA1	Maths	Graph Theory
MA2	Maths	Linear Algebra
PH1	Physics	Nanomaterials and Technology
PH2	Physics	Optoelectronic devices and applications
PH3	Physics	Fiber optics communication
NCC	NCC	National Cadet Corps

Linear Algebra & Ordinary Differential Equations

B.Tech – I Semester (20IT101/MA01)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- solve a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors.
- identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order ordinary differential equations.
- create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
- solve a linear differential equation with constant coefficients with the given initial conditions using Laplace Transforms.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Find the eigen values and eigen vectors of a given matrix and its inverse.

CO2 Apply the appropriate analytical technique to find the solution of a first order ordiniary differential equation.

CO3 Solve higher order linear differential equations with constant coefficients arise in engineering applications.

CO4 Apply Laplace transform to solve differential equations arising in engineering

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	-	-	-

UNIT - I **(12 Hours)**

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).
[Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

UNIT - II **(12 Hours)**

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli's equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation $Mdx + Ndy = 0$.
Applications of a first order Differential equations: Newton's law of cooling; Rate of decay of Radio-active materials.
[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6; 12.8]

UNIT - III **(12 Hours)**

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.
[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5]

UNIT - IV **(12 Hours)**

Laplace Transforms: Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by t^n; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace transforms.
[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

TEXT BOOKS:

1. B.S.Grewal. *Higher Engineering Mathematics*. Khanna, 44 edition, 2017a

REFERENCES:

1. Erwin Kreyszig. *Advanced Engineering Mathematics*. John Wiley and Sons, 9 edition, a
2. N.P.Bali and M.Goyal. *A Text book of Engineering Mathematics*. Laxmi, 2010a

Engineering Chemistry
B.Tech – I Semester (20IT102/CY01)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
- understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
- familiarize with the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics.
- gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.

CO2 Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion.

CO3 Have the capacity of applying energy sources efficiently and economically for various needs.

CO4 Design economically and new methods of organic synthesis and substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	-	-	2	3	-	-	-	3	-	-	-
CO2	2	3	2	3	-	-	2	3	-	-	-	3	-	-	-
CO3	2	3	2	3	-	-	2	3	-	-	-	3	-	-	-
CO4	2	3	2	3	-	-	2	3	-	-	-	3	-	-	-

UNIT - I **(12 Hours)**

Water Chemistry
Introduction: water quality parameters.
Characteristics: Alkalinity, Hardness - Estimation & simple numerical problems.
Boiler Troubles - Sludges, Scales, Caustic embrittlement, boiler corrosion, Priming and foaming;
Internal conditioning - phosphate, calgon and carbonate methods.
External conditioning - Ion exchange process & Zeolite process
WHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration.
Disinfection methods: Chlorination, ozonization and UV treatment.
Salinity – Treatment of Brackish water by Reverse Osmosis and Electrodialysis.

UNIT - II **(12 Hours)**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.
Corrosion: Types of corrosion - Chemical or dry corrosion, Electrochemical or wet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion, Corrosion control – Cathodic protection, and electro plating (Au) & electoless Ni plating.

UNIT - III **(12 Hours)**

Fuels: Classification of fuels; Calorific value of fuels (lower, higher)
Solid fuels: Determination of calorific value (Bomb Calorimeter) & related problems, Coal ranking.
Liquid Fuels: Petroleum refining and fractions, composition and uses. Knocking and anti- knocking Agents, Octane number and Cetane number; Bio fuels- Biodiesel, general methods of preparation and advantages.
Gaseous fuels: CNG and LP.
Flue gas analysis – Orsat apparatus.

UNIT - IV **(12 Hours)**

Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution (SN1, SN2), addition (Markownikoff's and anti-Markwnikoff's rules) , elimination (E1 & E2), Synthesis of a commonly used drug molecule.(Aspirin and Paracetamol)
Polymers: Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications.
Plastics: Thermoplasts and thermosetting plastics, Bskelite and PVC.
Bio degradable polymers: Types, examples-Polyhydroxy buterate (PHB), Polyhydroxy buterate-co-β-hydroxy valerate (PHBV), applications.

TEXT BOOKS:

1. P.C. Jain and Monica Jain. *Engineering Chemistry*. Dhanpat Rai, 17 edition, 2017
2. Seshi Chawla. *Engineering Chemistry*. Dhanpat Rai, 13 edition, 2013

REFERENCES:

1. Arun Bahl, B.S. Bahl, and G.D.Tuli. *Essential Of Physical Chemistry*. S Chand, 12 edition, 2012
2. C.P. Murthy, C.V. Agarwal, and A. Naidu. *Text Book of Engineering Chemistry*. B.S, 2006
3. K. Maheswaramma. *Engineering Chemistry*. Pearson, 2015

Basic Electrical & Electronics Engineering
B.Tech – I Semester (20IT103/EE01)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Solve problems that includes DC and AC excitation sources in electrical circuits.

CO2 Compare properties of magnetic materials and its applications.

CO3 Analyze construction, principle of operation, application and performance of DC machines and AC machines.

CO4 Explore characteristics and applications of semiconductor diode and transistor family.

CO5 Make the static converters and regulators

CO6 Analyze concepts of power transistors and operational amplifiers closer to practical applications

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT - I (12 Hours)

Electrical Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation.Superposition, Thevenin and Norton Theorems. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II **(12 Hours)**

Electrical Machines:

Magnetic materials, BH characteristics, Construction, working of DC machines, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.Auto-transformer and three-phase transformer connections.Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor.Single-phase induction motor. Construction and working of synchronous generators.

UNIT - III **(12 Hours)**

Semiconductor Diodes and applications:

Semiconductor materials, semiconductor diode, Resistance levels, Diode equivalent circuits, Zener diode, Light emitting diode, Load line analysis, half wave rectification, Full wave rectification, Bridge rectifier, Use of capacitor filter in rectifier, Zener diode voltage regulator, Clippers, Clampers

Bipolar Junction Transistors:

Transistor construction and operation, Common base configuration, Transistor amplifying action, Common emitter configuration, Common collector configuration, Limits of operation. DC load line and bias point, Voltage divider bias of transistor.

UNIT - IV **(12 Hours)**

Field Effect Transistors:

Construction and characteristics of JFET and MOSFET

Operational Amplifiers:

Introduction, Differential and common mode operation, OP-AMP Basics, Practical OP-AMP circuits: Inverting amplifier, Non inverting amplifier, Unity follower, summing amplifier, Integrator and differentiator.

TEXT BOOKS:

1. S.K. Bhattacharya. *Basic Electrical and Electronics Engineering*. Pearson
2. Robert L. Boylestad and Louis Nashelsky. *Electronic Devices and Circuit Theory*. PHI, 11 edition
3. Nagsarkar T K and Sukhija M S. *Basics of Electrical and Electronics Engineering*. Oxford University Press

REFERENCES:

1. David A. Bell. *Electronic Devices and Circuits*. Oxford University Press, 5 edition
2. Muthusubramanian R, Salivahanan S, and Muraleedharan K A. *Basic Electrical, Electronics and Computer Engineering*. Tata McGraw Hill, 2 edition, 2006

Engineering Graphics

B.Tech – I Semester (20ITL101/MEL01)

Lectures	:	1 Hours / Week	Tutorial	:	0	Practical	:	4
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand the importance of engineering graphics in the field of engineering
- familiarize with drawing skills and Bureau of Indian Standards
- familiarize with geometric constructions, engineering curves, orthographic projections and pictorial projections
- visualize orientation of points, lines, surfaces and solids
- familiarize with drafting skills using Auto CAD

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Draw projections of points and projections of lines using Auto CAD.

CO2 Plot projections of surfaces like Circle, Square and Rhombus

CO3 Plot the Projections of solids like Prisms and Pyramids

CO4 Convert Orthographic views into Isometric views of simple objects

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1	2	1	-	-	-	-	-	3	3	-	3	-	-	-
CO 2	3	2	1	-	-	-	-	-	3	3	-	3	-	-	-
CO 3	1	2	3	-	-	-	-	-	3	3	-	3	-	-	-
CO 4	1	2	1	-	-	-	-	-	3	3	-	3	-	-	-

UNIT - I

Introduction: Introduction to Drawing instruments and their uses, geometrical construction procedures
Introduction to auto CAD: Basics of sheet selection, Draw tools, Modify tools, dimensioning
Method of Projections: Principles of projection - First angle and third angle projection of points. Projection of straight lines. Traces of lines.

UNIT - II

Projections of Plane: Projections of plane figures: circle, square, rhombus, rectangle, triangle, pentagon and hexagon.

UNIT - III

Projections of Solids: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones Inclined to one plane.

UNIT - IV

Isometric Projections: Isometric Projection and conversion of Orthographic views into isometric views. (Treatment is limited to simple objects only).

UNIT - V

Orthographic Projections: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

TEXT BOOKS:

1. Dhananjay M. Kulkarni. *Engineering Drawing with AutoCAD*. PHI
2. N.D. Bhatt and V.M. Panchal. *Engineering Drawing-First angle projection*. Charotar Publishing House

REFERENCES:

1. Dhananjay A Jolhe. *Engineering Drawing*. Tata McGraw Hill
2. K.L.Narayana and R.K.Kannaiah. *Engineering Drawing*

Chemistry Lab

B.Tech – I Semester (20ITL102/CYL01)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Familiar with fundamental basics of Chemistry lab

CO2 Estimate purity of washing soda, bleaching powder and quantity of Iron and other salts.

CO3 Calculate the quality parameters of water like salinity, hardness, alkalinity etc.

CO4 Analyse the given oil for saponification and iodine value. Prepare high polymers and soap.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	2	-	-	-	-	2	-	-	-
CO3	2	2	2	2	-	-	2	-	-	-	-	2	-	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	2	-	-	-

LIST OF EXPERIMENTS

1. Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. and error, accuracy, precision, theory of indicators, use of volumetric titrations).
2. Volumetric Analysis:
   (a) Estimation of Washing Soda.
   (b) Estimation of Active Chlorine Content in Bleaching Powder
   (c) Estimation of Mohr's salt by permanganometry.
   (d) Estimation of given salt by using Ion-exchange resin using Dowex-50.
3. Analysis of Water:
   (a) Determination of Alkalinity of Tap water.
   (b) Determination of Total Hardness of ground water sample by EDTA method

(c) Determination of Salinity of water sample

4. Estimation of properties of oil:
   (a) Estimation of Acid Value
   (b) Estimation of Saponification value
5. Preparations:
   (a) Preparation of Soap
   (b) Preparation of Urea-formaldehyde resin
   (c) Preparation of Phenyl benzoate
6. Demonstration Experiments (Any two of the following):
   (a) Determination of pH of given sample.
   (b) Determination of conductivity of given sample by conductometer.
   (c) Potentiometric Determination of Iron.

TEXT BOOKS:

1. K.Mukkanti. *Practical Engineering Chemistry*. B.S, 2009
2. Vogel. *Inorganic quantitative analysis*. Longman group, 5 edition, 1979

REFERENCES:

1. R.N. Goyal and Harrmendra Goel. *Text Book of engineering chemistry*
2. S.S. Dara. *A text book on experiments and calculations- Engineering Chemistry*
3. Chatwal Anand. *Instrumental methods of chemical analysis*. Himalaya

Basic Electrical and Electronics Engineering Lab

B.Tech – I Semester (20ITL103/EEL01)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Validate the basic network theorems such as KCL, KVL, superposition, Thevenin's and Norton's theorems.

CO2 Measure the parameters of choke coil.

CO3 Figure out the parameters, regulation, and efficiency of single-phase transformer.

CO4 Discriminate between the characteristics of PN junction diode, Zener diode and Transistor.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	1	3	-	-	-	-	3	2	-	-	-	-	-
CO 2	3	3	1	3	-	-	-	-	3	2	-	-	-	-	-
CO 3	3	3	1	3	-	-	-	-	3	2	-	-	-	-	-
CO 4	3	3	1	3	-	-	-	-	3	2	-	-	-	-	-

List of Experiments

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Parameters of choke coil
6. Measurement of low and medium resistance using volt ampere method
7. OC & SC test of single phase transformer
8. Load test on single phase transformer

9. V-I characteristics of PN junction Diode
10. V-I characteristics of Zener Diode
11. Characteristics of CE Configuration
12. Transfer and Drain Characteristics of JFET
13. Calculation of Ripple factor using Half wave rectifier
14. Calculation of Ripple factor using Full wave rectifier
15. Non linear wave shaping – clippers / clampers

Note: Minimum 10 experiments should be carried out in the lab.

Workshop Practice Lab

B.Tech – I Semester (20ITL104/MEL2)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Make half lap joint, Dovetail joint and Mortise & Tenon joint

CO2 Produce Lap joint, Tee joint and Butt joint using Gas welding

CO3 Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools

CO4 Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	3	2	-	2	-	2	-	-	1	-	2	-	-	-
CO 2	2	3	2	-	2	-	2	-	-	1	-	2	-	-	-
CO 3	2	3	2	-	2	-	2	-	-	1	-	1	-	-	-
CO 4	-	-	2	-	2	-	2	-	-	1	-	1	-	-	-

IT Workshop Lab

B.Tech – I Semester (20ITL104)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Make half lap joint, Dovetail joint and Mortise & Tenon joint.

CO2 Produce Lap joint, Tee joint and Butt joint using Gas welding.

CO3 Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools.

CO4 Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	3	2	-	2	-	2	-	-	1	-	2	-	-	-
CO 2	2	3	2	-	2	-	2	-	-	1	-	2	-	-	-
CO 3	2	3	2	-	2	-	2	-	-	1	-	1	-	-	-
CO 4	-	-	2	-	2	-	2	-	-	1	-	1	-	-	-

List of Experiments

1. Explore various input/output devices of a computer.
2. Explore Peripheral Component Interface cards of a computer.
3. Explore Mother Board components and Layouts.
4. Managing storage devices.
5. Assemble a computer.
6. Install and Uninstall System and Application software on a computer.
7. Tweak BIOS configurations.
8. Connect computers in a Local Area Network.
9. Troubleshoot a computer.

Environmental Studies
B.Tech – I Semester (20IT104/MC01)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	0	Credits	:	0

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand the Ecosystems and need of Biodiversity.
- develop an awareness and knowledge on natural resource protection and Sustainability
- realize and explore the problems related to Environmental pollution and its Management & Acts associated with Environment.
- understand global environmental problems.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Compare various ecosystems such as forest, grassland, desert, and aquatic case studies, relate to the environmental concepts & the levels of energy flow in an ecosystem, Discuss the preventive as well as remedial measures for conservation of biodiversity

CO2 Integrate and analyse the various natural and man made factors that affect forests, environment & propose alternative sources of energy to meet the growing energy needs of our population. Identify the importance of sustainable growth and developmental

CO3 Evaluate the pollution case studies and propose control measures of Urban and industrial wastes. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

CO4 describe the significance of economic, political, and social issues in the design and evaluation of environmental policies, reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	-	2	2	-	1	1	-	2			
CO 2	-	-	-	-	-	2	2	-	2	1	-	1			
CO 3	-	-	-	-	-	3	3	1	2	3	2	1			
CO 4	-	-	-	-	-	1	2	1	2	1	-	3			

UNIT - I (7 Hours)

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries).

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. Chipko movement case study

UNIT - II (8 Hours)

Natural resources:

Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. Forest: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. Water: Uses, floods and drought, Dams - benefits and problems.

Energy: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. Silent Valley Project and Narmada Bachao Andolan case studies

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.

UNIT - III (7 Hours)

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; Chernobyl Nuclear Disaster case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermicomposting.

Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act.

UNIT - IV (8 Hours)

Environmental issues: Green house effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment. Environmental Standards (ISO 14000, etc.)

Case Studies: Bhopal Tragedy, Mathura Refinery and TajMahal, and Ralegan Siddhi (Anna Hazare).

Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture.

TEXT BOOKS:

1. Benny Joseph. *Environmental Studies*. Tata McGraw-Hill

2. JP Sharma. *Comprehensive environmental studies*. Laxmi Publications
3. Erach Bharucha. *Text Book of environmental Studies*

REFERENCES:

1. R.Rajagopalan. *Environmental studies*. Oxford University Press
2. Anjaneyulu Y. *Introduction to Environmental Science*. B S Publications
3. Jr. G. Tyler Miller. *Environmental Science*. Thomson Series, 11 edition

Numerical Methods and Advanced Calculus

B.Tech – II Semester (20IT201/MA02)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Solve non-linear equations and system of linear equations with the help of Numerical techniques.

CO2 Solve the first order ordinary differential equations numerically with the given initial condition.

CO3 Find the area and volume of plane and three dimensional figures using multiple integrals.

CO4 Apply vector integral theorems to obtain the solutions of engineering problems involving circulation, flux, and divergence in vector fields.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-

UNIT - I (12 Hours)

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iterative method, Gauss-Seidel iterative method.
[Sections: 28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1;28.7.2].

UNIT - II (12 Hours)

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton's interpolation formulae: Newton's forward interpolation formula, Newton's backward interpolation formula; Interpolation with unequal intervals; Lagrange's interpolation formula; Divided differences; Newton's divided difference formula; Numerical integration; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule; Numerical solution of ODE's: Introduction; Picard's

method; Euler's method; Runge-Kutta method.
[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.2; 32.4; 32.7].

UNIT - III **(12 Hours)**

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integrals.
[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2].

UNIT - IV **(12 Hours)**

Vector Calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green's theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem (without proof).
[Sections: 8.4; 8.5; 8.5.1; 8.5.3; 8.6; 8.11.1; 8.12.2; 8.12.3; 8.13; 8.14; 8.16]

TEXT BOOKS:

1. B.S.Grewal. *Higher Engineering Mathematics*. Khanna, 44 edition, 2017b

REFERENCES:

1. Erwin Kreyszig. *Advanced Engineering Mathematics*. John Wiley and Sons, 9 edition, b
2. N.P.Bali and M.Goyal. *A Text book of Engineering Mathematics*. Laxmi, 2010b

Semiconductor Physics and Nano Materials
B.Tech – II Semester (20IT202/PH03)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- know the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
- to understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
- know the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics.
- gain knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Recognize the concepts of hole, effective mass of the electron in semiconductors, and band structure of solids.

CO2 Know the concept of Fermi level and various semiconductor junctions.

CO3 Knowledge the principles of operation and applications of various opto-electronic devices.

CO4 Recognize the significance of nanomaterials and their distinctive features.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	2	2	-	2	-	-	-	2	-	-	-	-
CO 4	3	-	-	2	2	-	-	-	-	-	2	2	-	-	-

UNIT - I

Electronic Materials: Sommerfeld free electron theory, Fermi level and energy, density of states, Failure of free electron theory (Qualitative), Energy bands in solids, E-K diagrams, Direct and Indirect band gaps. Types of Electronic materials: Metals, Semi conductors and Insulators, Occupation Probability, effective mass, Concept of hole.

UNIT - II

Semiconductors: Introduction to semiconductors, intrinsic and extrinsic semiconductors, carrier concentrations, Fermi level and temperature dependence, Continuity equation, Diffusion and drift, P-N junction (V-I characteristics), Metal – Semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for Opto-Electronic devices.

UNIT - III

Opto-Electronic Devices and Display Devices: Photo voltaic effect, principle and working of LED, Applications of Photo diode, Solar cell, PIN & APD Diode, Liquid crystal display.
Opto-Electric Effect: Faraday Effect and Kerr effect.

UNIT - IV

Nano-Materials: Introduction to nano technology, quantum confinement, surface to volume ratio, properties of nano materials.
Synthesis of Nano-Materials: CVD, sol-gel methods, laser ablation.
Carbon Nano Tubes: Types, properties, applications.
Characterization of Nano-Materials: XRD, SEM.
Applications of Nano-Materials.

TEXT BOOKS:

1. Avadhanulu and Kshirsagar. *A Text Book of Engineering Physics*. S.Chand and Co., 2013
2. P.Srinivasa Rao and K.Muralidhar. *Applied physics*
3. Charles Kittel. *Introduction to Solid State Physics*. 8 edition
4. S.O. Pillai. *Solid State Physics*

REFERENCES:

1. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and J. Murday. *Text book on Nanoscience and Nanotechnology*. Springer Science and Business Media, 2013
2. P.Srinivasa Rao and K.Muralidhar. *Basic Engineering Physics*. Himalaya, 2016

Communicative English
B.Tech – II Semester (20IT203/EL01)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims

- at enhancing the vocabulary competency of the students
- to enable the students to demonstrate proficiency in the use of written English, including proper spelling, grammar, and punctuation
- to enhance theoretical and conceptual understanding of the elements of grammar
- understand and apply the conventions of academic writing in English
- to enhance the learners' ability of communicating accurately and fluently

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 understand how to build academic vocabulary to enrich their writing skills

CO2 produce accurate grammatical sentences

CO3 analyse the content of the text in writing

CO4 produce coherent and unified paragraphs with adequate support and detail

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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	-	-	-

UNIT - I **(12 Hours)**

Vocabulary Development: Word formation-Formation of Nouns, Verbs and Adjectives from Root words-Suffixes and Prefixes
Essential Grammar: Prepositions, Conjunctions, Articles
Basic Writing Skills: Punctuation in writing
Writing Practices: Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT - II **(11 Hours)**

Vocabulary Development: Synonyms and Antonyms
Essential Grammar: Concord, Modal Verbs, Common Errors
Basic Writing Skills: Using Phrases and clauses
Writing Practices: Hint Development, Essay Writing

UNIT - III **(11 Hours)**

Vocabulary Development: One word Substitutes
Essential Grammar: Tenses, Voices
Basic Writing Skills: Sentence structures (Simple, Complex, Compound)
Writing Practices: Note Making

UNIT - IV **(12 Hours)**

Vocabulary Development: Words often confused
Essential Grammar: Reported speech, Common Errors
Basic Writing Skills: Coherence in Writing: Jumbled Sentences
Writing Practices: Paraphrasing and Summarising

REFERENCES:

1. Sanjay Kumar and Pushpa Latha. *Communication Skills*. Oxford University Press, 2011
2. Michael Swan. *Practical English Usage*. Oxford University Press, 1995
3. F.T.Wood. *Remedial English Grammar*. Macmillan, 2007
4. Liz Hamp lyons and Ben Heasley. *Study Writing*. Cambridge University Press, 2006

Programming for Problem Solving
B.Tech – I Semester (20IT204/CS01)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
- develop problem solving skills to translate 'English' described problems into programs written using C language.written using C language.
- use Conditional Branching, Looping, and Functions.
- apply pointers for parameter passing, referencing and differencing and linking data structures.
- manipulate variables and types to change the problem state, including numeric,character, array and pointer types, as well as the use of structures and unions, File.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Identify the right data representation formats based on the requirements of the problem and solve the mathematical problems using operators

CO2 Choose various decision-making statements based on the requirement

CO3 Execute programs on one, two and multidimensional arrays and using user defined functions

CO4 Solve real time complex problems by using structures and pointers

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO 2	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO 3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO 4	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2

UNIT - I **(11 Hours)**

Overview of C, Constants, Variables and Data Types, Operators and Expressions,Managing I/O Operations. Decision Making and Branching.

Programming Exercises for Unit I:C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers. Computation of discount amount on different types of products with different discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its upper case.

UNIT - II **(12 Hours)**

Decision Making and Looping, Arrays, Character Arrays and Strings.

Programming Exercises for Unit II: To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number. To print graphic patterns of symbols and numbers. To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

UNIT - III **(12 Hours)**

User-defined Functions,Structures and Unions,Pointers

Programming Exercises for Unit - III: Functions - Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers

UNIT - IV **(12 Hours)**

File Management in C,Dynamic Memory Allocation,Preprocessor

Programming Exercises for Unit - IV: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

TEXT BOOKS:

1. E.Balaguruswamy. *Programming in ANSI C*. McGraw Hill India, 8 edition, 3 2019. ISBN 978-93-5316-513-0

REFERENCES:

1. Kernighan BW and Dennis Ritchie M. *The C programming language*. Prentice Hall, 2 edition, 2015. ISBN 987-93-325-4944-9
2. Herbert Schildt. *C: The Complete Reference*. McGraw Hill India, 4 edition, 2017a. ISBN 0-07-212124-6
3. Ashok N.Kamthane and Amit A.Kamthane. *Programming in C*. McGraw Hill India, 3 edition, 2015. ISBN 987-93-325-4355-3

ON-LINE RESOURCES:

1. Anupam Basu. *Problem Solving through Programming in C*. IIT Kharagpur, 2018. URL `https://youtu.be/t9WKOcRB63Q?list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1`

Digital Logic Design

B.Tech – I Semester (20IT205/CC01)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand fundamental concepts and techniques used in digital electronics and minimize boolean expressions by applying Boolean algebra and K-map methods
- minimize Boolean expressions by tabulation method and understand, analyze and design various combinational logic circuits.
- use basic flip-flops, analyze and design synchronous and asynchronous sequential circuits
- understand the design principles of Registers, Counters, Memories and Programmable Logic Devices.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Explain digital number system, boolean algebra, circuit design and minimization.

CO2 Design the combinational circuits

CO3 Analyze synchronous sequential circuits

CO4 Design registers, counters and memories.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-

UNIT - I **(11 Hours)**

Digital Systems and Binary Numbers: Digital System, Binary Numbers, Number base Conversions, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic, Error Detection and Correction: 7 bit Hamming Code.

Boolean Algebra & Logic Gates: Introduction, Basic definitions, Axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra, Boolean functions, Canonical and Standard Forms, Other Logic Operations, Digital logic gates.

Gate Level Minimization: Introduction, The map method, Four-variable K-Map, Product-of-Sums Simplification, Don't–Care Conditions, NAND and NOR implementation, Other Two level Implementations.

UNIT - II **(12 Hours)**

Minimization: The Tabulation method, Determination of prime implicants, Selection of prime-implicants.

Combinational Logic: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adders - Subtractor, Decimal Adder, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT - III **(12 Hours)**

Synchronous Sequential Logic: Introduction, Sequential Circuits, Storage Elements - Latches, Storage Elements -Flip Flops, Analysis of Clocked Sequential Circuits: State Equations, State Table, State Diagram, Flip Flop Input Equations, Analysis with D, JK and T Flip Flops; State reduction and Assignment, Design Procedure.

UNIT - IV **(11 Hours)**

Registers and Counters: Registers, Shift registers, Ripple Counters, Synchronous Counters.
Memory and Programmable Logic: Introduction, Random Access Memory: Read and Write Operations, Types of Memories; Read Only Memory, Programmable Logic Devices: PROM, PLA, PAL.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti. *Digital Design*. Prentice Hall, 5 edition, 1 2013. ISBN 978013277420

REFERENCES:

1. John F. Wakerly. *Digital Design: Principles and Practices*. Pearson, 4 edition, 2006. ISBN 9780131863897
2. R. H. Katz and G. Borriello. *Contemporary Logic Design*. Pearson, 2 edition, 2005. ISBN 9780201308570
3. Brain Holdsworth and Clive Woods. *Digital Logic Design*. Elsevier Publisher, 4 edition, 2002. ISBN 978-0080477305

ON-LINE RESOURCES:

1. S.Srinivasan. *Digital Circuits & Systems*. IIT Madras, 2007. URL

https://youtu.be/CeD2L6KbtVM?list=PL803563859BF7ED8C

Discrete Mathematics

B.Tech – I Semester (20IT206/CC02)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- familiarize with basic mathematical objects such as sets, functions, relations and natural numbers and their properties.
- to solve problems using counting techniques and combinatorics in the context of discrete probability.
- solve problems involving recurrence relations and generating functions.
- analyze inhomogeneous recurrence relations and use digraphs as tools to visualize and simplify the problems.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Apply mathematical foundations to validate the logical inference patterns.

CO2 Apply rules for proving problems related to mathematical induction and permutations & combinations.

CO3 Solve problems involving recurrence relations and generating functions.

CO4 Solve the problems related to Relations and Di-graphs

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 2	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 3	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2

UNIT - I **(11 Hours)**

Foundations: Sets, Relations and Functions, Fundamentals of Logic, Logical Inferences, Methods of Proof of an implication, First order Logic & Other methods of proof.

UNIT - II **(12 Hours)**

Rules of Inference for Quantified propositions, Mathematical Induction.

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutation with Constrained repetitions.

UNIT - III **(12 Hours)**

Recurrence relations: Generating functions of sequences, Calculating Coefficients of generating Functions, Solving recurrence relations by Substitution and generating functions, The methods of characteristic roots.

UNIT - IV **(12 Hours)**

Recurrence Relations: Solutions of inhomogeneous recurrence relations.

Relations: Special properties of binary relations, Operations on relation. Ordering relations, Lattice, Paths and Closures, Directed Graphs and Adjacency Matrices.

TEXT BOOKS:

1. Joe L.Mott, Abraham Kandel, and Theodore P.Baker. *Discrete Mathematics for Computer Scientists and Mathematicians*. Pearson Education, 2 edition, 2008. ISBN 9788120315020
2. Ralph P. Grimaldi. *Discrete and Combinatorial Mathematics*. Pearson Education, 5 edition, 2004. ISBN 978-8177584240

REFERENCES:

1. Kenneth H. Rosen. *Discrete Mathematics and its Applications*. McGraw Hill, 7 edition, 2012. ISBN 9780073383095
2. D.S. Malik and M.K. Sen. *Discrete Mathematical Structures: Theory and Applications*. Thomson, 3 edition, 2004. ISBN 9780619212858

ON-LINE RESOURCES:

1. Sudarshan Iyengar. *Introduction to Discrete Mathematics*. IIT Madras, 2019. URL `https://youtu.be/2-Ayb4GGwbY?list=PLyqSpQzTE6M-hUn1ILCzWE2gc592_DgK4`

Semiconductor Physics Lab
B.Tech – I Semester (20ITL201/PHL02)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Acknowledge the important aspects of earth magnetic field, realize the use of Maxwells equations in various magnetic applications

CO2 Realization of material properties and parameters.

CO3 Get hands on experience in various opto-electronic devices like Solar Cell, Photo Cell and their applications.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	2	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	3	2	2	-	-	-	-	2	2	-	-	-	-	-
CO 3	3	3	2	2	2	-	-	-	2	-	-	-	-	-	-

List of Experiments

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands.
4. Determination of radius of curvature of a plano convex lens by forming Newton's rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.
8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.

9. Verify the laws of transverse vibration of stretched string using sonometer.
10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si & Ge.
15. Determination of wavelength of laser source using Diode laser.

Any three experiments are virtual

TEXT BOOKS:

1. P.Srinivasarao and K.Muralidhar. *Engineering physics laboratory manual*. Himalaya

English Communication Skills Lab
B.Tech – I Semester (20ITL202/ELL01)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

English Communication Skills (ECS) Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.

Prerequisites:

None

Course Objectives:

The course aims

- to sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- to bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- to improve students' fluency in English and neutralize their mother tongue
- to make them use effective vocabulary both in formal and informal situations

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 better understand the nuances of English language through audio-visual experience and group activities

CO2 develop neutralization of accent for intelligibility

CO3 build confidence to enhance their speaking skills

CO4 use effective vocabulary both in formal and informal situations

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	-	-	-	-	3	2	2	2	-	-	-
CO 2	-	-	-	-	-	-	-	-	3	2	2	2	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	2	2	2	-	-	-
CO 4	-	-	-	-	-	-	-	-	3	2	2	2	-	-	-

UNIT - I **(12 Hours)**

1.1 Listening Skills; Importance – Purpose- Process- Types

1.2 Barriers to Listening

1.3 Strategies for Effective Listening

UNIT - II **(12 Hours)**

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds

2.2 Stress

2.3 Rhythm

2.4 Intonation

UNIT - III **(12 Hours)**

3.1 Formal and Informal Situations

3.2 Expressions used in different situations

3.3 Introducing Yourself & Others-Greeting & Parting-Congratulating-Giving Suggestions & Advices-Expressing Opinions-Inviting People-Requesting-Seeking Permission-Giving Information- Giving Directions- Sympathizing- Convincing People- Complaining & Apologizing-Thanking Others- Shopping- Travelling- Conversational Gambits

UNIT - IV **(11 Hours)**

4.1 JAM Session

4.2 Debates

4.3 Extempore

TEXT BOOKS:

1. Sanjay Kumar and Pushpa Lata. *Communication Skills*. Oxford University Press, 2011
2. J.D.O Connor. *Better English Pronunciation*. Cambridge University Press, 1984
3. Jack C Richards. *New Interchange*. Cambridge University Press, 4 edition, 2015
4. Grant Taylor. *English Conversation Practice*. Mc Graw Hill, 2001

SOFTWARE:

1. Buzzers for conversations, New Interchange series
2. English in Mind series, Telephoning in English
3. Speech Solutions, A Course in Listening and Speaking

Programming for Problem Solving Lab
B.Tech – II Semester (20ITL203/CSL01)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Solve basic arithmetic and local operations using C Language

CO2 Solve computational problems using control structures of C Language

CO3 Implement programs using user defined functions for the real time problems.

CO4 Implement programs with structures, unions and files.

Mapping of COs with POs & Program Specific Outcomes (PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 2	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 3	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 4	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3

LIST OF EXPERIMENTS

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement).
2. Write a C program to evaluate the following (using loops):
   (a) $1 + \frac{x^2}{2!} + \frac{x^4}{4!} +$…upto ten terms
   (b) $x + \frac{x^3}{3!} + \frac{x^5}{5!} +$ … upto 7 digit accuracy
3. Write a C program to check whether the given number is
   (a) Prime or not.
   (b) Perfect or Abundant or Deficient.
4. Write a C program to display statistical parameters (using one – dimensional array).
   (a) Mean
   (b) Mode
   (c) Median

Domestic Customer:	
Consumption Units	**Rate of Charges(Rs.)**
0 – 200	0.50 per unit
201 – 400	100 plus 0.65 per unit
401 – 600	230 plus 0.80 per unit
601 and above	390 plus 1.00 per unit
Commercial Customer:	
Consumption Units	**Rate of Charges(Rs.)**
0 – 100	0.50 per unit
101 – 200	50 plus 0.6 per unit
201 – 300	100 plus 0.70 per unit
301 and above	200 plus 1.00 per unit

(d) Variance.

5. Write a C program to read a list of numbers and perform the following operations
   (a) Print the list.
   (b) Delete duplicates from the list.
   (c) Reverse the list.
6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message "Element not found in the List".
7. Write a C program to read two matrices and compute their sum and product.
8. A menu driven program with options (using array of character pointers).
   (a) To insert a student name
   (b) To delete a student name
   (c) To print the names of students
9. Write a C program to read list of student names and perform the following operations
   (a) To print the list of names.
   (b) To sort them in ascending order.
   (c) To print the list after sorting.
10. Write a C program that consists of recursive functions to
    (a) Find factorial of a given number
    (b) Solve towers of Hanoi with three towers (A, B & C) and three disks initially on tower A.
11. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required ,if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.
12. Write a C program to read a data file of students' records with fields(Regno, Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

Microprocessor and Microcontrollers
B.Tech – III Semester (20IT301)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to identify the hardware and software elements of the 8086 microprocessor.
- to understand instruction set of 8086 microprocessor with examples.
- to interface the interrupt device with 8086 microprocessor.
- to comprehend the architecture of 8051 microcontroller and its applications.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe the architecture and assembly language programming of an 8086

CO2 Describe an 8086 programming structure, strings and procedures

CO3 Explain pin configuration and interrupts of an 8086

CO4 Discuss architecture, pin configuration and programming of an 8051 microcontroller

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 2	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 3	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 4	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2

UNIT - I (11 Hours)

Introduction to 8086: The 8086 Microprocessor family-overview; 8086 internal architecture: the execution unit, the BIU;

8086 Family Assembly Language Programming: Program development steps, constructing the machine codes for 8086 instructions, writing program for use with an assembler, assembly language program development tools.

UNIT - II **(12 Hours)**

Implementing standard Program Structures in 8086 Assembly language: Simple sequence programs, jumps flags and conditional jumps, if-then if-then-else multiple if-then-else programs, while do programs, repeat-until programs, instruction timing and delay loops

Strings and procedures: The 8086 string instructions, writing and using procedures; assembler directives.

UNIT - III **(12 Hours)**

8086 system connections and timing: The basic 8086 Microcomputer system, 8086 Bus activities during the read machine cycle, 8086 Bus activities during the write machine cycle 8086 pin diagram

8086 Interrupts and Interrupt Applications: 8086 Interrupts and Interrupts Responses, 8259A priority interrupt controller.

UNIT - IV **(11 Hours)**

8051 Microcontrollers: Microcontrollers and embedded processors, overview of the 8051 family; architecture of 8051, pin diagram of 80851; 8051 assembly language programming; JUMP, LOOP, CALL instructions; I/O port programming; addressing modes; LCD and keyboard interfacing.

TEXT BOOKS:

1. Douglas V. Hall and SSSP Rao. *Microprocessors and Interfacing*. Mc Graw Hill, 3 edition, 2017. ISBN 9781259006159
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi. *The 8051 Microcontroller and Embedded Systems*. Pearson, 2 edition, 2021. ISBN 9788131710265

REFERENCES:

1. Glenn A Gibson Yu-cheng Liu. *Microcomputer systems: The 8086 /8088 Family architecture, Programming and Design*. Pearson, 2 edition, 2015. ISBN 9789332550087
2. Barry B Brey. *The Intel Microprocessors*. Pearson, 8 edition, 2018. ISBN 9788131726228

ON-LINE RESOURCES:

1. Shaik Rafi Ahmed. *Microprocessors and Interfacing*. IIT Guwahati, 2019. URL `https://youtu.be/0t4LROuEVnw?list=PLwdnzlV3ogoXgNjr_oe5cWQIbf72ZY4Zf`

Data Structures

(Common to CSE & IT)

B.Tech – III Semester (20IT302/CC03)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Programming for Problem Solving (20IT204)

Course Objectives:

The course aims to enable the students

CO1 to understand and calculate the complexity of various algorithms.

CO2 to understand the applications and implementation of Linked Lists, Stacks, Queues, Trees and Priority Queues.

CO3 to understand and implement internal sorting algorithms.

CO4 to understand and implement Hashing methods.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Implement the linked list abstract data type.

CO2 Use Stack ADT for expression evaluation and Queues for radix sort

CO3 Implement different tree abstract data types including BST and AVL Tree

CO4 Demonstrate various hashing techniques and heap sort algorithm.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2

UNIT - I **(12 Hours)**

Algorithm Analysis: Mathematical Background, Model, what to Analyze, Running Time Calculations.

Lists: Abstract Data Types, The List ADT, Singly Linked List ADT, Doubly Linked List ADT, Circular Linked List ADT, Polynomial ADT: addition, multiplication operations.

UNIT - II **(12 Hours)**

Stacks and Queues: The Stack ADT and its applications such as Infix to Postfix expression conversions, Evaluation of Postfix expressions. The Queue ADT, Queue Application-Radix sort.

Basic Sorting Techniques: Bubble sort, Selection sort, Insertion sort, Shell sort.

UNIT - III **(12 Hours)**

Trees: Preliminaries, Binary Trees, Expression trees, The Search Tree ADT, Binary Search Trees, Implementation. AVL Trees, Single Rotations, Double rotations, Implementations.

UNIT - IV **(11 Hours)**

Hashing: General Idea, Hash Function, Separate Chaining, Open Addressing.
Priority Queues (Heaps): Model, Simple implementations, Binary Heap, Heap Sort.

TEXT BOOKS:

1. Mark Allen Weiss. *Data Structures and Algorithm Analysis in C*. Pearson Education, 2 edition, 2013. ISBN 978-81-7758-358-8

REFERENCES:

1. M.J.Augeustein Y.Langsam and A.M.Tenenbaum. *Data Structures Using C*. Pearson Education Asia, 2 edition, 2006. ISBN 81-203-1177-9
2. Behrouz A. Forouzan Richard F.Gilberg. *Data Structures – A Pseudocode Approach with C*. ThomsonBrooks / COLE, 2 edition, 1998. ISBN 978-0-534-39080-8
3. J.E. Hopcroft Alfred Aho and J.D. Ullman. *Data Structures and Algorithms*. Pearson Education Asia, 1 edition, 1983. ISBN 978-0201000238

ON-LINE RESOURCES:

1. Dr.Naveen Garg. *Introduction to Data Structures and Algorithms*. IIT Delhi, 2008. URL `https://youtu.be/zWg7U0OEAoE?list=PLBF3763AF2E1C572F`

Object Oriented Programming

(Common to CSE & IT)

B.Tech – III Semester (20IT303/CC04)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Programming for Problem Solving(20IT204)

Course Objectives:

The course aims to enable the students

- to understand the principles of object oriented programming.
- to understand the principles of inheritance
- to understand and write programs on Exception Handling, I/O, and Multithreading.
- to develop java applications using Applets, AWT, Swings and Events.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Explain the concepts of OOP and fundamentals of Java Programming.

CO2 Develop reusable and efficient programs using Inheritance, Polymorphism and Collections.

CO3 Demonstrate the exception handling to create error free codes and avoid abnormal program Terminations and multi-tasking applications using Multithreading.

CO4 Develop Event driven applications and Generic programs using AWT and Swings.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2

UNIT - I **(11 Hours)**

The History and Evolution of Java, An Overview of Java, Data Types, Variables and Arrays, Operators, Control Statements, Introducing Classes, A COser Look at Methods and Classes.

UNIT - II **(12 Hours)**

Inheritance

Packages and Interfaces

Strings: String Constructors, Program using 10 String methods StringBuffer class, Program using 10 StringBuffer methods Introducing StringBuilder class.

Type Wrappers: Auto boxing/unboxing.

Collections: Collections Overview, Names of Collection Interfaces, Classes. Programs using Collection classes LinkedList <String>, ArrayList < String >

UNIT - III **(12 Hours)**

Exception Handling

Multithreaded Programming

I/O: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter class, Reading and Writing Files, Automatically COsing a File

UNIT - IV **(12 Hours)**

The Applet Class: Applet Architecture, An Applet Skeleton, Applet program to draw shapes, setting Color, Font using Graphics class

Event Handling:

Introduction to AWT: Window Fundamentals, Program using AWT components Label, Text Field, Text Area, Checkbox, Checkbox Group, Button, Program using Flow Layout, Grid Layout, and Border Layout.

GUI Programming with Swing: The Origins of Swing, Advantages of Swing over AWT, The MVC Connection, Program using Swing Components JLabel, JText Field, JText Area, JCheck box, JButton, JTabbed Pane, JTable, JTree, JCombo Box

TEXT BOOKS:

1. Herbert Schildt. *Java The Complete Reference*. Tata Mc Graw Hill, 9 edition, 2017b. ISBN 978-5845917591

REFERENCES:

1. Cay Horstmann and John Wiley. *Big Java*. Wiley, 4 edition, 2009. ISBN 978-0470509487
2. H.M.Dietel and P.J.Dietel. *Java How to Program (Early Objects)*. Pearson Education, 11 edition, 2018. ISBN 978-9353062033

ON-LINE RESOURCES:

1. Debasis Samanta. *Object Oriented Programming With Java*. IIT Kharagpur, 2019. URL `https://youtu.be/OjdT2l-EZJA?list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQOho`

Operating Systems

(Common to CSE & IT)

B.Tech – III Semester (20IT304/CC05)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to learn the mechanism of OS to handle processes & Threads and their communication.
- to learn the algorithms involved in CPU scheduling.
- to gain knowledge on concepts that includes Dead locks, Main Memory and Virtual Memory.
- to know the concepts related to File Access Methods & Mass Storage structure.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication

CO2 Explain the different CPU scheduling Algorithms

CO3 Explain various memory management schemes

CO4 Discuss File system structure and Mass storage structure

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	3	-	-	-	-	-	-	-	2	3	2	2
CO 2	3	2	2	3	-	-	-	-	-	-	-	2	3	2	2
CO 3	3	2	2	3	-	-	-	-	-	-	-	2	3	2	2
CO 4	3	2	2	3	-	-	-	-	-	-	-	2	3	2	2

UNIT - I **(11 Hours)**

Introduction: What OSs do?, Computer System Operation, Storage structure, OS Structure, OS Operations.

Operating-System Structures: OS Services, User and operating system Interface, System Calls, Types of System Calls, System Programs, OS Design and Implementation, OS Structure.

Processes: Process Concept, Process Scheduling, Operations on Processes, Inter- process Communication.

Threads: Overview, Multicore Programming, Multithreading Models.

[Sections:1.1, 1.2.1, 1.2.2, 1.4, 1.5, 1.5.1, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.7.1, 2.7.2, 2.7.3, 2.7.4, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3]

UNIT - II **(12 Hours)**

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of Synchronization, Monitors.

[Sections: 6.1, 6.2, 6.3, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8]

UNIT - III **(12 Hours)**

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery.

Main Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.

Virtual-Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Other Considerations.

[Sections: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.9]

UNIT - IV **(12 Hours)**

File System Interface: File concept, Access Methods, Directory and Disk Structure.

File System Implementation: File System Structures, Directory Implementation, Allocation Methods.

Protection: Goals of Protection, Principles of Protection, Domain of Protection- Domain Structure, Access Matrix, Implementation of Access Matrix.

Mass Storage Structure: Over View, Disk Structure, Disk Scheduling, Disk Management, RAID levels

[Sections:10.1, 10.2, 10.4, 10.5, 10.7, 11.1, 11.2, 11.3, 11.5, 12.1, 12.3, 12.4, 14.1, 14.2, 14.3, 14.3.1, 14.4, 14.5]

TEXT BOOKS:

1. Greg Gagne Avil Silberschatz, Peter Baer Galvin. *Operating system Concepts*. John Wiley and Sons, 10 edition, 2018. ISBN 9781118063330

REFERENCES:

1. William Stallings. *Operating System : Internals and Design Principles*. Pearson, 9 edition, 2018. ISBN 9789352866717
2. Charles Crowley. *Operating Systems: A Design-Oriented Approach*. Tata McGraw Hill, 2019. ISBN 9780074635513

ON-LINE RESOURCES:

1. Chester Rebeiro. *Introduction to Operating Systems*. IIT Madras, 2016. URL `https://youtu.be/jciGIvn7UfM?list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk`

Computer Organization

(Common to CSE & IT)

B.Tech – III Semester (20IT305/CC06)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Digital Logic Design(20IT205)

Course Objectives:

The course aims to enable the students

- Conceptualize the basics of organizational and architectural issues of a digital computer and classify and compute the performance of machines, machine instructions.
- Learn about various data transfer techniques in digital computer and the I/O interfaces.
- Estimate the performance of various classes of Memories, build large memories using small memories for better performance and Relate to arithmetic for ALU implementation
- Understand the basics of hardwired and micro-programmed control of the CPU, pipelined architectures , Hazards and Superscalar Operations.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe components, architecture of a computer system and its working.

CO2 Explain instruction execution and control system.

CO3 Discuss algorithms related to computer arithmetic operations

CO4 Illustrate I/O Organization and memory hierarchy

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	-	-	-	-	-	-	-	-	-	2	3	2	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO 4	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2

UNIT - I **(11 Hours)**

Data Representation: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation.

Register Transfer Language and Micro-operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic micro operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

UNIT - II **(12 Hours)**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Design of Accumulator Logic.

Micro Programmed Control: Control Memory, Address Sequencing, Microprogram Example, Design of Control Unit.

UNIT - III **(12 Hours)**

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer vs Complex Instruction Set Computers.

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

UNIT - IV **(12 Hours)**

The Memory System: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor.

TEXT BOOKS:

1. Hamacher Carl, ZvonkoVranesic, and SafwatZaky. *Computer Organization and Embedded Systems*. McGraw Hill, 6 edition, 2014. ISBN 9781259005275

REFERENCES:

1. Stallings William. *Computer Organization and Architecture*. Pearson/PHI, 11 edition, 03 2019. ISBN 9780135188941
2. Kaufmann Morgan. *Computer Architecture –A Quantitative Approach*. Pearson/PHI, 6 edition, 12 2017. ISBN 978-0128119051
3. M. Morris Mano. *Computer Systems Architecture*. Pearson/PHI, 3 edition, 5 2004. ISBN 978-9332585607
4. Hayes John P. *Computer Architecture and Organization*. McGraw Hill, 3 edition, 6 1998. ISBN 9781259028564

ON-LINE RESOURCES:

1. S.Raman. *Computer Organization*. IIT Madras, 2008. URL `https://youtu.be/leWKvuZVUE8?list=PL1A5A6AE8AFC187B7`

Technical English

B.Tech – III Semester (20IT306/EL02)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims

- at enhancing the vocabulary competency of the students
- to introduce corrective measures to eliminate grammatical errors in speaking and writing
- to learn writing as a process, including various invention heuristics (such as brainstorming), gathering evidence, considering audience, drafting, revising, editing, and proofreading
- use grammatical, stylistic, and mechanical formats and conventions appropriate for a variety of purposes
- produce coherent, organized, readable prose for a variety of rhetorical situations

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 make use of contextual clues to infer meanings of unfamiliar words from context

CO2 understand how to apply technical information and knowledge in practical documents for a variety of purposes

CO3 analyze the content of the text in writing use grammatical, stylistic, and mechanical formats and conventions appropriate to various audiences and disciplines.

CO4 build confidence to participate actively in writing activities (individually and in collaboration) that model effective technical communication in the workplace

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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	-	-	-

UNIT - I **(12 Hours)**

Vocabulary Development: Familiarising Idioms & Phrases
Grammar for Academic Writing: Making Requests
Language Development: Using Transition & Link words
Technical Writing: Letter Writing & Email Writing

UNIT - II **(10 Hours)**

Vocabulary Development: Analogous words, Gender Sensitive language
Grammar for Academic Writing: Tenses: Simple Past /Present Perfect, The Future: Predicting & Proposing
Language Development: COze tests
Technical Writing: Technical Reports

UNIT - III **(10 Hours)**

Vocabulary Development: Abbreviations & Acronyms
Grammar for Academic Writing: Describing(People/Things/Circumstances) : Adjectival & Adverbial groups
Language Development: Transcoding (Channel conversion from chart to text)
Technical Writing: Circular, Memos, Minutes of Meeting

UNIT - IV **(10 Hours)**

Vocabulary Development: Corporate vocabulary
Grammar for Academic Writing: Inversions & Emphasis
Language Development: Reading Comprehension
Technical Writing: Resume Preparation

REFERENCES:

1. a
2. b
3. c
4. d
5. e

Linux Essentials

(Common to CSE & IT)

B.Tech – III Semester (20ITL301/SOC1)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	3
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3.5

Prerequisites:

–

Course Objectives:

The course aims to enable the students

- to organize and manipulate files and directories and Use the vi text editor to create and modify files.
- to use SED command for insertion, deletion, and search and replace (substitution) and Understand pattern scanning and processing using AWK.
- to create structured shell programming which accept and use positional parameters and exported variables.
- to understand File management system calls to provide I/O support for storage device types and multiple users.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Write basic commands for data processing

CO2 Apply filter commands on data files

CO3 Develop shell script programs for applications

CO4 Develop programs on file management system calls for applications

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	2	2	-	-	-	3	2	-	2	3	2	2
CO 2	3	2	2	2	2	-	-	-	3	2	-	2	3	2	2
CO 3	3	2	2	2	2	-	-	-	3	2	-	2	3	2	2
CO 4	3	2	2	2	2	-	-	-	3	2	-	2	3	2	2

UNIT - I

Directory commands: pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names.
File related commands: Editing with vi, cat, mv, rm, cp , wc . File attributes and permissions and knowing them. The ls command with options. Changing file permissions: (chmod) the relative and absolute permissions changing methods. Recursively changing file permissions. Directory Permissions.
Other Basic commands: cal, date, df, du, find, jobs, kill ,less and more, ps, set, wc, who.

Work Sheet

1. Obtain the following results (i) To print the name of operating system (ii) To print the login name (iii) To print the host name.
2. Find out the users who are currently logged in and find the particular user too.
3. Display the calendar for (i) Jan 2000 (ii) Feb 1999 (iii) 9th month of the year 7 A.D (iv) For the current month (v) Current Date Day Abbreviation , Month Abbreviation along with year.
4. Display the time in 12-Hour and 24 Hour Notations.
5. Display the Current Date and Current Time.
6. Display the message ―GOOD MORNING in enlarged characters.
7. Display the name of your home directory.
8. Create a directory SAMPLE under your home directory.
9. Create a subdirectory by name TRIAL under SAMPLE.
10. Change to SAMPLE.
11. Change to your home directory.
12. Change from home directory to TRIAL by using absolute and relative pathname.
13. Remove directory TRIAL.
14. Create a directory TEST using absolute pathname.
15. Using a single command change from current directory to home directory.
16. Remove a directory using absolute pathname.
17. Create files my file and your file under Present Working Directory.
18. Display the files my file and your file.
19. Append more lines in the my file and your file files.
20. How will you create a hidden file?.
21. Copy myfile file to emp.
22. Write the command to create alias name for a file.
23. Move yourfile file to dept.

24. Copy emp file and dept file to TRIAL directory
25. Compare a file with itself.
26. Compare myfile file and emp file.

UNIT - II

The Stream Editor(sed): Line addressing, multiple instructions, context addressing, writing selected lines to a file, text editing ,substitution, basic regular expressions.
File Handling and Text Processing utilities: grep, egrep, fgrep.
AWK: sample awk filtering , splitting a line into fields, formatting output, variables and expressions, comparison operators, number processing, storing awk programs in a file, the BEGIN and END sections, Built in variables and arrays, control structures.

Work Sheet

1. **Create the following file as sed.lab: unix is great os. unix is open source. unix is free os. learn operating system. Unix linux which one you choose.(Each sentence in a line)**

   - Replace _unix‘ with _linux‘.
   - Replace only the third (3rd) instance of _unix‘ with _linux‘.
   - Try sed ‘s/unix/linux/g‘ sed.lab.
   - Replace _unix‘ with _linux‘ but only on line 3.
   - Add a new line, _Actually Windows is best‘ after the second line.

2.
   - Viewing a range of lines of a document
   - Viewing the entire file except a given range
   - Viewing non-consecutive lines and ranges
   - Replacing words or characters inside a range
   - Using regular expressions
   - Viewing lines containing with a given pattern
   - Inserting spaces in files
   - Performing two or more substitutions at once

3.
   - Design a command **“wishme”** that will great you —good morning‖,‖good Afternoon‖, according to current time.
   - Design a command **“fags”** thats will list the files and their ages, to date.
   - Design a command **“word-freq”** that will print the words and number of Occurrences of that word in the given text.

UNIT - III

Shell programming: shell,functions of shell,metacharacters,input redirections and output redirections,pipes, shell as a programming language,shell variables,predefined local variables,predefined environment variables,arithmetic and conditional expressions ,control structures,positional parameters,passing command line arguments,built in shell comands,shell programs,functions and arrays.

Work Sheet

1.
   - Design a command **" which"** that prints the path of the command given as Argument
   - Design a command **"filelist[-c <char>]"** which prints all file names beginning with The charter specified as argument to the command ,if the position is not specified It should print all the file names.
   - Design a command **getline[-f <filename> -n <line number>]** which prints the line number lineno in the file specified with -f option.If the line number is not specified it should list all the lines in the given file
   - Design a command **monthly-file[-m <month>]** which list the files created in a given month where month is argument to be command. If the options is not specified it list the files in all the months.
2.
   - Design a command **list lines[-f <file name> -v <varname>]** which prints the line from the given file file name ,which containing the variable varname.if arname Is not specified it should list ,all the lines.
   - Design a command **avg[-n <colon> -f <file name>]** which prints the average of the given column in a file where colon and file name are arguments to the commands

UNIT - IV

File management System calls: Regular File management system calls: open(), read(), write(), lseek(), COse(), unlink(), stat(), getdents().

Work Sheet

1. Write a C program to copy data from source file to destination file, where the file names are provided as command-line arguments.
2. Write a C program that reads every 100th byte from the file, where the file name is given as command-line argument.
3. Write a C program to display information of a given file which determines the type of file and inode information, where the file name is given as command-line arguments.

TEXT BOOKS:

1. Sumitabha Das. *UNIX Concepts and Applications*. Tata McGraw Hill, 4 edition, 2019. ISBN 9780040635463
2. Graham Glass and King Ables. *UNIX for programmers and users*. Pearson, 3 edition, 2003. ISBN 9780130465535

REFERENCES:

1. Maurice J.Bach. *The Design of UNIX operating System*. PHI, 1 edition, 2015. ISBN 9789332549579
2. W Richard Stevens. *Advanced programming in the UNIX environment*. Pearson, 3 edition, 2013. ISBN 9780321637734
3. Sumitabha Das. *Your UNIX/Linux the ultimate guide*. TMH, 3 edition, 2013. ISBN 9780073376202

ON-LINE RESOURCES:

1. Anand Iyer. *Linux Programming & Scripting*. IIT Madras, 2008. URL `https://youtu.be/leWKvuZVUE8?list=PL1A5A6AE8AFC187B7`

Data Structures Lab

(Common to CSE & IT)

B.Tech – III Semester (20ITL302/CC07)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIA Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Solve computational problems using the Linked List Abstract Data Type

CO2 Solve computational problems using the Stack and Queue ADTs.

CO3 Solve computational problems using the Binary Search Trees and AVL Tree ADTs.

CO4 Implement various Hashing techniques and Disjoint set ADT.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 2	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 3	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 4	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3

List of Experiments

1. Write a program to perform the following operations on Array List 1.Creation,2.Insertion, 3.Deletion, 4.Search, 5.Display.
2. Write a program that reads two lists of elements, prints them, reverses them,Prints the reverse list, sort the lists, print the sorted lists, merges the list, prints merge list using array list.
3. Write a program to perform the following operations on Single Linked List. a)Creation b)Insertion c)Deletion d)Search e)Display.
4. Write a program to perform the following operations on Doubly Linked List. a)Creation b)Insertion c)Deletion d)Search e)Display.
5. Write a program to perform addition and multiplication of two polynomials using single Linked List.
6. Write a program to implement the following using stack. a) infix to postfix conversion b) postfix evaluation
7. Write a program that performs Radix sort on a given set of elements using queue.
8. Write a program to perform the following operations on Disjoint Set. a)Make-Set b)Find-Set c)Union.

9. Write a program to read n numbers in an array. Redisplay the arraylist with elements being sorted in ascending order using Heap Sort.
10. Write a program to demonstrate Binary Expression tree.
11. Write a program to perform Binary Search tree operations and traversals.
12. Write a program to implement AVL tree that interactively allows (a) Insertion (b)Deletion (c) Find_min (d) Find_max.
13. Write a program to implement DFS & BFS graph traversing techniques.
14. Write a program to find an element using Open Addressing.

Object Oriented Programming Lab

(Common to CSE & IT)

B.Tech – III Semester (20ITL303/CC08)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIA Marks	:	30	SEE Marks	:	70	Credits	:	1.5

List of Experiments

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Implement OOP concepts using its advantages over structured programming.

CO2 Develop and implement inheritance, polymorphism.

CO3 Analyze Exception Handling, Multithreading, I/O.

CO4 Create code for Event Handling, Applets, AWT and Swings.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 2	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 3	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO 4	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3

1. Write a java program to demonstrate static member, static method and static block.
2. Write a java program to demonstrate method overloading and method overriding.
3. Write a java program to implement multiple inheritance.
4. Write a java program to demonstrate finals, blank finals, final methods, and final classes.
5. Write a program to demonstrate packages.
6. Write a java program to demonstrate interfaces.
7. Write a java program to crate user defined exception class and test this class.
8. Write a java program to demonstrate synchronous keyword.
9. Write am applet program to demonstrate Graphics class.
10. Write GUI application which uses awt components like label, button, text filed, text area, choice, checkbox, checkbox group.

11. Write a program to demonstrate MouseListener, MouseMotionListener, KeyboardListener, ActionListener, ItemListener.
12. Develop swing application which uses JTree, Jtable, JComboBox.

Probability and Statistics

B.Tech – IV Semester (20IT401/MA03)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand the principles of statistical methods and probability concepts that serves the foundations for the applications of methods in engineering.
- understand the applications of various t-tests to various problems in the field of engineering.
- understand the application of completely randomized designs (CRD) and randomized block designs (RBD) to different realistic problems in the field of engineering.
- understand the applications of single and multiple regression analysis to the regression model arising in the field of engineering.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Apply discrete and continuous probability distributions to various problems arising in Engineering applications.

CO2 Perform Test of Hypothesis for a population parameter for single sample.

CO3 Perform Test of Hypothesis for population parameters for multiple samples.

CO4 Interpret the results of correlation, regression and one way ANOVA for the given data.

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	-	-	-	-	-	-	-	-	-	2			
CO2	3	3	2	-	-	-	-	-	-	-	-	2			
CO3	3	3	2	-	-	-	-	-	-	-	-	2			
CO4	3	3	3	-	-	-	-	-	-	-	-	2			

UNIT - I **(11 Hours)**

Probability Densities: Continuous Random Variables, The Normal Distribution, The Normal Approximation to the Binomial Distribution, The Uniform Distribution, The Gamma Distribution, The Beta Distribution, The Weibull distribution, Joint Distributions - Discrete and Continuous.
(Sections 5.1, 5.2, 5.3, 5.5, 5.7, 5.8, 5.9, 5.10 of the Text Book)

UNIT - II **(12 Hours)**

Sampling Distributions: Populations and Samples, The sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance.
Inferences Concerning a Mean: Point estimation, Interval estimation, Tests of Hypotheses, Null Hypotheses and Tests of hypotheses, Hypothesis concerning one mean.
(Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6 of the Text Book)

UNIT - III **(12 Hours)**

Comparing Two Treatments: Comparisons-Two independent Large samples, Comparisons-Two independent small samples, Matched pairs comparisons.
Inferences Concerning Variances: The estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances.
(Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3 of the Text Book)

UNIT - IV **(11 Hours)**

Inferences Concerning Proportions: Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions.
Regression Analysis: The method of least squares, Curvilinear regression, Multiple regression, Correlation.
(10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6 of the Text Book)

TEXT BOOKS:

1. Richard A. Johnson. *Miller and Freund's Probability and Statistics for Engineers*. PHI, 8 edition

REFERENCES:

1. R.E Walpole, R.H. Myers, and S.L. Myers. *Probability & Statistics for Engineers and Scientists*. PHI, 6 edition

ON-LINE RESOURCES:

1. G.Srinivasan. *Probability and Statistics*. IIT Madras, 2019. URL `https://youtu.be/0t4LROuEVnw?list=PLwdnzlV3ogoXgNjr_oe5cWQIbf72ZY4Zf`

Web Technologies

B.Tech – IV Semester (20IT402/CC09)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Programming for Problem Solving (20IT204)

Course Objectives:

The course aims to enable the students

- understand the web page and identify it's elements and attributes.
- to create web pages using HTML5 and Cascading Styles sheets.
- to implement dynamic web pages using JavaScript (client side programming).
- to design web site with functionality using AJAX

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Analyze a web page and identify its elements and attributes.

CO2 Develop a dynamic web pages by the use of java script and DHTML

CO3 Write a well formed / valid XML document.

CO4 Demonstrate interactive web applications using AJAX

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	-	2	-	2	-	-	-	3	3	3	2
CO2	3	3	2	2	3	2	-	2	-	-	-	3	3	3	2
CO3	3	3	2	2	3	2	-	2	-	-	-	3	3	3	2
CO4	3	3	2	2	3	2	-	2	-	-	-	3	3	3	2

UNIT - I (15 Periods)

HTML5: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Colors and Canvas, Working with Forms.

UNIT - II **(15 Periods)**

CSS: Overview of CSS, Backgrounds and Color Gradients in CSS, Fonts and Text Styles, Creating Boxes and Columns Using CSS, Displaying, Positioning, and Floating an Element, List Styles, Table Layouts.

Dynamic HTML: Overview of JavaScript, JavaScript Functions, Events, Image Maps, and Animations.

UNIT - III **(15 Periods)**

Dynamic HTML(Cont..): JavaScript Objects, Working with Browser Objects, Working with Document Object.

Document Object Model: Understanding DOM Nodes, Understanding DOM Levels, Understanding DOM Interfaces - Node , Document, Element, Attribute.

UNIT - IV **(15 Periods)**

XML: Working with Basics of XML, Implementing Advanced Features of XML, Working with XSLT.

AJAX: Overview of AJAX, Asynchronous Data Transfer with XMLHttpRequest, Implementing AJAX Frameworks, Working with jQuery.

TEXT BOOKS:

1. Kogent Learning Solutions Inc. *HTML 5 Black Book*. Wiley India, 7 edition, 2011. ISBN 9789350040959

REFERENCES:

1. Paul Deitel, Harvey Deitel, and Abbey Deitel. *Internet and World wide web: How to program*. Pearson, 11 edition, 2011. ISBN 9780132990455
2. Tom Negrino and Dori Smith. *Javascript and Ajax for the Web*. Peachpit Press PTG, 7 edition, 2009. ISBN 9780321564085

ON-LINE RESOURCES:

1. I.Sengupta. *Internet Technologies*. IIT Kharagpur, 2008. URL `https://youtu.be/YOXwcbwSEUo?list=PLbMVogVj5nJSsxplPGgKHZLgdzL5-O88`

Database Management Systems
B.Tech – IV Semester (20IT403/CC10)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to describe the fundamental elements of relational database management systems.
- to explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- to design ER-models to represent simple database application scenarios.
- to improve the database design by normalization.
- to familiarize with basic database storage structures and access techniques: file and page organizations, indexing methods including B trees and B+ trees.
- to familiar with basic concurrency control techniques and recovery techniques.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Demonstrate the entity relationship model for modeling the relational databases.

CO2 Write a SQL query to perform CRUD operations on the real time databases.

CO3 Apply normalization techniques to reduce redundancy in relational databases.

CO4 Demonstrate concurrency control and database recovery mechanism in RDBMS.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	2	-	-	-	-	-	2	3	3	2
CO2	3	3	3	3	3	2	-	-	-	-	-	2	3	3	2
CO3	3	3	3	3	3	2	-	-	-	-	-	2	3	3	2
CO4	3	3	3	3	3	2	-	-	-	-	-	2	3	3	2

UNIT - I **(11 Hours)**

Databases and Database Users: Introduction - An Example, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: DataModels, Schemas and Instances ,Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architectures for DBMSs.

Data Modelling Using the Entity-Relationship (ER) Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database - ER Diagrams, Naming Conventions, and Design Issues.

UNIT - II **(12 Hours)**

The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, The Tuple Relational Calculus, The Domain Relational Calculus.

Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, INSERT, DELETE, and UPDATE Statements in SQL , Views (Virtual Tables) in SQL.

UNIT - III **(12 Hours)**

Indexing Structures for Files: Types of Single-Level Ordered Indexes, Multilevel Indexes - Dynamic Multilevel Indexes Using B-Trees and B+-Trees.

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Design Algorithms and Further Dependencies: Properties of Relational Decompositions -Lossless Join Decomposition and Dependency Preserving Decomposition, Algorithms for Relational Database Schema Design, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT - IV **(12 Hours)**

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability.

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multi version Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking.

Database Recovery Techniques: Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging.

TEXT BOOKS:

1. Ramez Elmasri and Navate. *Fundamentals of Database Systems*. Pearson Education, 6 edition, 2017. ISBN 978-0-136-08620-8

REFERENCES:

1. Johannes Gehrke Raghurama Krishnan. *Data base Management Systems*. TATA McGrawHill, 3 edition, 2014. ISBN 978-8131769591
2. Korth Silberschatz. *Data base System Concepts*. McGraw hill, 6 edition, 2013. ISBN 978-9332901384
3. C.J.Date. *Introduction to Database Systems*. Pearson Education, 8 edition, 2006. ISBN 978-8177585568

ON-LINE RESOURCES:

1. D.Janakiram. *Introduction to Database Management System*. IIT Madras, 2008. URL `https://youtu.be/EUzsy3W4I0g?list=PL9426FE14B809CC41`

Design and Analysis of Algorithms
B.Tech – IV Semester (20IT404/CC11)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Data Structures (20IT302)

Course Objectives:

The course aims to enable the students

- to compare algorithms for a given task based on Time and Space complexities.
- find solutions for a problem using Greedy and Dynamic Programming methods.
- to understand Graph search algorithms.
- find solutions for a problem using Backtracking and Branch and Bound methods.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Calculate the time complexity of a given algorithm

CO2 Solve the given problem using greedy method or divide & conquer approach

CO3 Solve the given problem using dynamic programming or graph theory approach

CO4 Solve the given problem using back tracking or branch & bound approach

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	-	2	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	-	2	-	-	-	-	-	2	3	3	3
CO3	3	3	3	3	-	2	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	-	2	-	-	-	-	-	2	3	3	3

UNIT - I (11 Hours)

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh-notation, Omega notation, Theta notation and Little oh notation, Probabilistic analysis, Amortized analysis

Master Theorem: Introduction, Generic Form- Case1, Case2, Case3, Inadmissible equations,

Application to common algorithms

UNIT - II **(12 Hours)**

Divide and conquer : General method , applications - Quick sort, Merge sort, Strassen's matrix multiplication.

Greedy method : General method, applications-Job sequencing with deadlines, Fractional knapsack problem, Minimum cost spanning trees - Prims, Kruskal, Single source shortest path problem - Dijkstra.

UNIT - III **(12 Hours)**

Dynamic Programming: General method, applications - 0/1 knapsack problem, Travelling salesperson problem, Longest common sequence algorithm, Multistage graphs using Forward & Backward approach, Reliability design.

Graph Searching and Traversal: Graph traversals - Depth first, Breadth first, Bio Connected Components, Strongly Connected Components.

UNIT - IV **(11 Hours)**

Back tracking: General method, applications-n-queen problem, sum of subsets problem.

Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP-Hard and NP Complete classes, Cook's theorem.

TEXT BOOKS:

1. E. Horowitz, S. Sahni, and S.Rajsekran. *Fundamentals of Computer Algorithms*. Orient Longman, 2 edition, 2018. ISBN 9788173716126

REFERENCES:

1. Michael Soltys-kulinicz. *Introduction to the Analysis Of Algorithms*. World Scientific, 3 edition, 2018. ISBN 9789813235908
2. Anany Levitin. *Introduction to the Design and Analysis of Algorithms*. Pearson, 3 edition, 2017. ISBN 9789332585485

ON-LINE RESOURCES:

1. Abhiram Ranade. *Design and Analysis of Algorithms*. IIT Bombay, 2008. URL `https://youtu.be/5Y8Lfsreeck?list=PLbMVogVj5nJSUpKllt0btml02Zsc9U1VU`

Python Programming

B.Tech – IV Semester (20ITL401/SOC2)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3.5

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to identify the syntax and semantics of Python
- to write python scripts for solving real time problems
- to enhance the object oriented programming skills of the students

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Identify the basic python constructs with a view of using them in problem solving

CO2 Explore the usability of functions and strings in modular programming

CO3 Apply lists, dictionaries, tuples and file operations to organize the data in real world problems

CO4 Implement the problems in terms of real world objects using object oriented and database concepts

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	-	-	-	3	2	-	2	3	2	2
CO2	3	2	2	2	3	-	-	-	3	2	-	2	3	2	2
CO3	3	2	2	2	3	-	-	-	3	2	-	2	3	2	2
CO4	3	2	2	2	3	-	-	-	3	2	-	2	3	2	2

UNIT - I (18 Hours)

Introduction: Overview, History of Python, Python Features, Environment Setup. Variables, expressions, and statements: values and types, variables, names and keywords, statements, operators and operands, expressions, order of operations, modulus operator, string operations, asking the user for input, comments, choosing mnemonic variable names.

Conditional execution: Boolean expressions, logical operators, conditional execution, alternative

execution, chained conditionals, nested conditionals, catching exceptions using try and except, short-circuit evaluation of logical expressions.
Iteration: updating variables, the while statement, infinite loops and break, finishing iterations with continue, definite loops using for, loop patterns.
Functions: function calls, built-in functions, type conversion functions, random numbers, math functions, adding new functions, definitions and uses, flow of execution, parameters and arguments, fruitful functions and void functions.

UNIT - II **(18 Hours)**

Strings: a string is a sequence, getting the length of a string using len, traversal through a string with a loop, string slices, strings are immutable, looping and counting, the in operator, string comparison, string methods, parsing strings, format operator.
Files I/O: persistence, opening files, text files and lines, reading files, searching through a file, letting the user choose the file name, using try except and open, writing files.
Lists: a list is a sequence, lists are mutable, traversing, operations, slices, methods, deleting elements, functions, strings, parsing lines, objects and values, aliasing, arguments.
Dictionaries: dictionary as a set of counters, dictionaries and files, looping and dictionaries, advanced text parsing.
Tuples: tuples are immutable, comparing tuples, tuple assignment, dictionaries and tuples, multiple assignment with dictionaries, the most common words, using tuples as keys in dictionaries, sequences.

UNIT - III **(18 Hours)**

Regular expressions: character matching in regular expressions, extracting data using regular expressions, combining searching and extracting, escape character.
ObjectOriented Programming: Managing Larger Programs, Using Objects, starting with Programs, Subdividing a Problem: Encapsulation, First Python Object, Classes as Types, Object Lifecycle, Many Instances, Inheritance.

UNIT - IV **(18 Hours)**

Exception Handling: Errors and Exceptions(From Web References text 1).
Using Databases and SQL: Database concepts, Database Browser for SQLite, creating a database table, Structured Query Language summary, Basic data modeling, Programming with multiple tables, three kinds of keys, Using JOIN to retrieve data.

LIST OF EXPERIMENTS

1. Write a script to print some Pythagorean triples.
2. Write a script that demonstrates string handling capabilities of Python.
3. Write a script that demonstrates associated arrays support in Python.
4. Write a script to print Fibonacci numbers up to and including the first command line argument.
5. Write a simple script that reads from a file details of students in a section and finds top ten meritorious students in the section.
6. Write a script to Implement Stack
7. Write a script to Implement Queue

Textbooks

1. Charles R Severance. *Python for Everybody: Exploring Data in Python 3*. 4 2016. ISBN 978-1530051120. doi: https://www.py4e.com/book
2. Ljubomir Perkovic. *Introduction to Computing Using Python: An Application Development Focus*. Wiley, 2 edition, 8 2015. ISBN 978-1118890943
3. Guido van Rossum and Jr Fred L. Drake. *Python Tutorial*. Python Software Foundation. doi: https://docs.python.org/3/

References

1. Kenneth A. Lambert. *Fundamentals oF Python : First Programs*. Cengage, 2 edition, 2019. ISBN 978-1337560092

Web Technologies Lab

B.Tech – IV Semester (20ITL402/CC12)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

Programming for Problem Solving (20ITL203/CSL01)

Course Objectives:

The course aims to enable the students

- to understand the web page and identify it's elements and attributes.
- to create web pages using HTML5 and Cascading Styles sheets.
- to implement dynamic web pages using JavaScript (client side programming).
- to design web site with functionality using AJAX

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Develop a static web applications using HTML5 and CSS

CO2 Create interactive web applications using Java script.

CO3 Develop a web page to convert XML data into HTML .

CO4 Apply ajax technologies to web application development.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO2	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO3	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO4	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3

List of Experiments

1. Design web pages to demonstrate different types of styles in CSS.
2. Write java scripts covering Function, recursive functions, Arrays and Objects.

3. Demonstrate collection objects.
4. Demonstrate event model.
5. Write well-formed and valid XML documents.
6. Write code for displaying XML using XSL.
7. Demonstrate Document Object Model for an XML document.
8. Demonstrate web applications using AJAX.
9. Installation of IIS and Apache Tomcat servers.
10. Demonstrate web applications using Jquery.

TEXT BOOKS:

1. Kogent Learning Solutions Inc. *HTML 5 Black Book*. Wiley India, 7 edition, 2011. ISBN 9789350040959

REFERENCES:

1. Paul Deitel, Harvey Deitel, and Abbey Deitel. *Internet and World wide web: How to program*. Pearson, 11 edition, 2011. ISBN 9780132990455
2. Tom Negrino and Dori Smith. *Javascript and Ajax for the Web*. Peachpit Press PTG, 7 edition, 2009. ISBN 9780321564085

RDBMS Lab

B.Tech – IV Semester (20ITL403/CC13)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Design database by using ER diagrams

CO2 Implement DDL, DML and DCL commands.

CO3 Implement aggregate functions and sub query concepts in SQL.

CO4 Implement Procedures, functions and cursors using PL/SQL.

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO2	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO3	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3
CO4	3	3	3	3	2	-	-	-	3	2	-	2	3	3	3

List of Experiments

1. **Working with DDL, DML, DCL and Key Constraints**
   Creation, Altering and Dropping of Tables and Inserting Rows into a Table (Use Constraints While Creating Tables) Examples Using Select Command.

2. **Working with Queries and Nested QUERIES**
   Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints.

3. **Working with Queries USING Aggregate Operators & views**
   Queries using Aggregate Functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and Dropping of Views.

4. **Working with Conversion Functions & String Functions**
   Queries using Conversion Functions (TO_CHAR, TO_NUMBER AND TO_DATE), String Functions (CONCATENATION, LPAD, RPAD, LTRIM, RTRIM, LOWER, UPPER, INITCAP,

LENGTH, SUBSTR AND INSTR), Date Functions (SYSDATE, NEXT_DAY, ADD_MONTHS, LAST_DAY, MONTHS_BETWEEN), LEAST, GREATEST, TRUNC, ROUND, TO_CHAR, TO_DATE.

5. **Working with LOOPS using PL/SQL**
   Program Development using WHILE LOOPS, FOR LOOPS, Nested Loops using ERROR Handling.

6. **Working with Functions Using PL/SQL**
   Program Development using Creation of Stored Functions, Invoke Functions in SQL Statements and Write Complex Functions.

7. **Working with Stored Procedures**
   Programs Development using Creation of Procedures, Passing Parameters IN and OUT of PROCEDURES.

8. **Working with CURSORS**
   Develop Programs using Features Parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of Clause and CURSOR Variables.

9. **Working with Triggers using PL/SQL**
   Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.

Professional Ethics & Human Values

(Common to CSE & IT)

B.Tech – IV Semester (20IT405/MC02)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	0	Credits	:	0

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to comprehend a specific set of behaviours and values any professional must know and must abide by, including confidentiality, honesty and integrity. Understand engineering as social experimentation.
- to know, what are Safety and Risk and understand the responsibilities and rights of an engineer such as collegiality, loyalty, bribes/gifts.
- to recognize global issues visualizing globalization, cross-cultural issues, computer ethics and also know about ethical audit
- to discuss case studies on Bhopal gas tragedy, Chernobyl and about codes of Institute of Engineers, ACM

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe values and engineering ethical theories

CO2 Explain the risks , safety and rights , responsibilities

CO3 Describe global issues and ethical audit

CO4 Explain the Bhopal gas tragedy, Chernobyl Disaster and codes of Engineers, ACM

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	-	-	-	-	-	3	3	2	3	-	-	2	-	-	-
CO 2	-	-	-	-	-	3	2	3	2	-	-	2	-	-	-
CO 3	-	-	-	-	-	2	2	3	3	-	2	2	-	-	-
CO 4	-	-	-	-	-	3	3	2	3	-	-	2	-	-	-

UNIT - I **(7 Hours)**

Human Values: Morals, Values and Ethics, Integrity, Work Ethics, Service and Learning, Civic Virtue, Respect for Others, Living Peacefully, Caring and Sharing, Honesty, Courage, Value Time, Cooperation, Commitment and Empathy,Spirituality,Character.

Engineering Ethics: History of Ethics, Engineering Ethics, Consensus and Controversy, Profession and Professionalism, Professional Roles of Engineers, Self Interest, Customs and Religion, Uses of Ethical Theories, Professional Ethics, Types of Inquiry, Kohlberg's Theory, Gilligan's Argument, Heinz's Dilemma.

Engineering as Social Experimentation: Comparison with Standard Experiments, Knowledge Gained, Conscientiousness, Relevant Information, Learning from the Past, Engineers as Managers, Consultants, and Leaders, Accountability, Roles of Codes, Codes and Experimental Nature of Engineering.

UNIT - II **(8 Hours)**

Engineers' Responsibility for Safety and Risk: Safety and Risk, Types of Risks, Safety and the Engineer, Designing for Safety, Risk-Benefit Analysis, Accidents.

Responsibilities and Rights: Collegiality, Two Senses of Loyalty, Obligations of Loyalty, Misguided Loyalty, Professionalism and Loyalty, Professional Rights, Professional Responsibilities, Conflict of Interest, Self-interest, Customs and Religion, Collective Bargaining, Confidentiality, Acceptance of Bribes/Gifts, Occupational Crimes, Whistle Blowing.

UNIT - III **(8 Hours)**

Global Issues: Globalization, Cross-cultural Issues, Environmental Ethics, Computer Ethics, Weapons Development, Ethics and Research, Analyzing Ethical Problems in Research, Intellectual Property Rights (IPRs).

Ethical Audit: Aspects of Project Realization, Ethical Audit Procedure, The Decision Makers, Variety of Interests, Formulation of the Brief, The Audit Statement, The Audit Reviews.

UNIT - IV **(7 Hours)**

Case Studies: Bhopal Gas Tragedy, The Chernobyl Disaster.

Appendix1: Institution of Engineers (India): Sample Codes of Ethics.

Appendix2: ACM Code of Ethics and Professional Conduct.

TEXT BOOKS:

1. M.Govindarajan, S.Natarajan, and V.S.Senthil Kumar. *Professional Ethics & Human Values*. PHI Learning, 2015. ISBN 9788120348165

Automata Theory and Formal Languages

(Common to CSE & IT)

B.Tech – V Semester (20IT501/CC14)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Discrete Mathematics(20IT206)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Design finite automata with and without epsilon transitions

CO2 Relate finite automata to regular expressions, minimize the finite automata and prove non-regularity of languages using pumping lemma

CO3 Draw parse trees for strings in CFGs, minimize the CFG, Equivalence of PDA and CFG

CO4 Construct Turing machines for a given task and differ decidable and undecidable problems

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	2	2	-	-	-	-	-	-	2	3	3	2
CO 2	3	3	3	2	2	-	-	-	-	-	-	2	3	3	2
CO 3	3	3	3	2	-	-	-	-	-	-	-	2	3	3	2
CO 4	3	3	3	2	2	-	-	-	-	-	-	2	3	3	2

UNIT - I (11 Hours)

Automata: Why Study Automata Theory?, The central concepts of automata theory - Alphabets, Strings, Languages, Problems.

Finite Automata: An Informal picture of finite automata, Deterministic finite automata (DFA) - Definition of DFA, DFA processing strings, Notations for DFA, Extended transition function, the language of DFA, Non deterministic finite automata (NFA) – Definition of NFA, Extended transition function, the language of NFA, Equivalence of DFA and NFA.

Automata with ϵ transitions: Use of ϵ - transition, notation for an ϵ - NFA, Epsilon COsures, extended transitions and languages, Eliminating I - transitions.

UNIT - II **(12 Hours)**

Regular Expressions and Languages: Regular expressions, finite automata and regular expressions, Algebraic laws of regular expressions.

Properties of Regular Languages: Proving languages are not regular – Pumping lemma for regular languages, Applications of the pumping lemma, COsure Properties of Regular Languages, Equivalence and minimization of automata – Minimization of DFA.

UNIT - III **(12 Hours)**

(Construction based treatment & proofs are excluded)

Context Free Grammars: Context Free Grammars, Parse Trees, ambiguous grammars.

Pushdown Automata: Definition of the Pushdown automata, the languages of PDA, Equivalences of PDAs and CFGs.

Context free languages: Normal form's for context- Free grammars, the pumping lemma for context free languages.

UNIT - IV **(11 Hours)**

Properties of Context free languages: COsure properties for context free languages, Decision properties for CFL's.

Introduction to Turing Machines: The Turing Machine, programming techniques for Turing machines.

Undecidability: a language that is not recursively enumerable, an undecidable problem that is RE, Undecidability problems about TM, Post's Correspondence problem.

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, and Jeffery D Ullman. *Introduction to Automata Theory Languages and Computations*. Pearson, 3 edition, 2008. ISBN 978131720479

REFERENCES:

1. KLP Mishra and N Chandrasekharan. *Theory of Computation*. PHI, 3 edition, 2006. ISBN 9788120329683
2. H R Lewis and C H Papadimitriou. *Elements of the Theory of Computation*. Pearson, 2 edition, 2015. ISBN 9789332549890

ON-LINE RESOURCES:

1. Kamala Krithivasan. *Computer-Theory of Automata, Formal Languages and Computation Theory of Automata*. IIT Madras, 2011. URL `https://youtu.be/-aIRqNnUvEg?list=PL85CF9F4A047C7BF7`

Computer Networks

(Common to CSE & IT)

B.Tech – V Semester (20IT502/CC15)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None The course aims to enable the students

Course Objectives:

- understand the principles of data communications and computer networking.
- understand network layer design, routing algorithms and congestion control algorithms.
- understand quality of services, transport services and Elements of Transport Protocols.
- understand transport layer protocols(UDP,TCP) and DNS application

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe the fundamentals of networks, network reference models and various error correction and detection techniques

CO2 Explain error control, flow control mechanisms used at data link layer and various routing and congestion control protocols in network design

CO3 Demonstrate the basic principles of IPV4 and its addressing mechanisms, elements of transport protocols in transport layer

CO4 Discuss the underlying protocols in transport layer and application layer.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO 4	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2

UNIT - I **(11 Hours)**

Data Communications & Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for a Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture.

Digital Data Communication Techniques: Asynchronous & Synchronous Transmission, Types of Errors, Error Detection, Error Correction.

Data Link Control: Flow Control, Error Control.

UNIT - II **(12 Hours)**

Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit & Datagram Subnets.

Routing Algorithms: The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing.

Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control.

UNIT - III **(12 Hours)**

Quality of Service: Requirements, Techniques for Achieving Good Quality of Service

The Network Layer in the Internet: The IP Protocol, IP Addresses, Internet Control Protocols.

The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives.

Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Crash Recovery.

UNIT - IV **(11 Hours)**

The Internet Transport Protocol (UDP): Introduction to UDP, Remote Procedure Call, The Real-Time Transport Protocol.

The Internet Transport Protocol (TCP): Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management, TCP Transmission Policy, TCP Congestion Control, TCP Timer Management.

The Domain Name System(DNS): The DNS Name Space, Resource Records, Name Servers.

TEXT BOOKS:

1. Behrouz A Forouzan. *Data Communications and Networking*. TMH, 4 edition, 2020. ISBN 9780321564085

2. Tanenbaum. *Computer Networks*. Pearson, 4 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Wayne Tomasi. *Introduction to Data Communications and Networking*. PHI, 1 edition, 2020. ISBN 9780321564085
2. GodBole. *Data Communications and Networking*. TMH, 1 edition, 2020. ISBN 9780321564085
3. Nader F. Mir. *Computer and Communication Networks*. PHI, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Soumya Kanti Ghosh and Sandip Chakraborty. *Computer Networks and Internet Protocol*. IIT Kharagpur, 2018. URL `https://youtu.be/O--rkQNKqls?list=PLEAYkSg4uSQ2NMmzNNsEK5RVbhxqx0BZF`

Software Engineering

(Common to CSE & IT)

B.Tech – V Semester (20IT503/CC16)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- understand different process models of Software Engineering.
- collect requirements from client and analyze the collected requirements.
- understand how to design and implement the Software Product or Project.
- understand the concepts of Testing and Measuring the software project or Product.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe software, myths and process models.

CO2 Discuss agile process models, requirements and modeling techniques of an analysis model.

CO3 Describe software architectural, component level design and user interface Design.

CO4 Explain software project metrics, quality assurance and software testing techniques/strategies.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	-	-	-	-	-	-	-	-	2	2	3	2	2
CO 2	3	2	2	-	2	-	-	-	-	-	2	2	3	2	2
CO 3	3	2	2	-	2	-	-	-	-	-	2	2	3	2	2
CO 4	3	2	2	-	2	-	-	-	-	-	2	2	3	2	2

UNIT - I **(11 Hours)**

Introduction to Software Engineering: The Evolving Role of Software, Software, The Changing Nature of Software, Legacy Software, Software Myths.

A Generic View of Process: Software Engineering - A Layered Technology, A Process Framework, the CMMI, Process Patterns, Process Assessment, Personal and Team Process Models, Product and Process.

Process Models: Prescriptive Models, The Waterfall Model, Incremental Process Models, Evolutionary Models, The Unified Process.

UNIT - II **(12 Hours)**

An Agile View of Process: What Is Agility? , What Is an Agile Process? , Agile Process Models.

Requirements Engineering: A Bridge To Design and Construction, Requirements Engineering Tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use-cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Building The Analysis Model: Requirements Analysis, Analysis Modelling Approaches, Data Modelling Concepts, Flow-Oriented Modelling, Class Based Modelling Creating a Behavioural Model.

UNIT - III **(12 Hours)**

Design Engineering: Design within the Context of Software Engineering, Design Process and Design Quality, Design Concepts The Design Model, Pattern Based Software Design.

Creating An Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs.

Modelling Component-Level Design: What Is a Component? , Designing Class-Based Components, Conducting Component-Level Design, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT - IV **(11 Hours)**

Software Process And Project Metrics: Introduction, Metrics Process and Project Domains, Software Measurement, Metrics for Software Quality, Integrating Metrics with Process.

Software Quality Assurance: Quality Concepts, Quality Movement, SQA, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Software Testing Strategies: Strategic Approach, Strategic Issues, Test strategies for Conventional Software, White box testing, Black Box testing, Test strategies for Object Oriented Software, Validation Testing, System Testing, The Art of Debugging.

TEXT BOOKS:

1. Roger S. Pressman. *Software Engineering A Practitioner's Approach*. Mc Graw Hill, 8 edition, 2014. ISBN 9780078022128

REFERENCES:

1. K.K. Aggarwal and Yogesh Singh. *Software Engineering*. New Age International, 3 edition, 2008. ISBN 9788122423600
2. Pankaj Jalote. *An Integrated Approach to Software Engineering*. Springer, 2 edition, 2005. ISBN 9780387208817
3. Ian Sommerville. *Software Engineering*. Pearson, 10 edition, 2017. ISBN 9789332582699
4. Carlo Ghezzi, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering*. PHI, 2 edition, 2002. ISBN 9788120322424
5. RajibMall. *Fundamentals of Software Engineering*. PHI, 5 edition, 2018. ISBN 9789388028028

ON-LINE RESOURCES:

1. Rajib Mall. *Software Engineering*. IIT Madras, 2018. URL `https://youtu.be/Ln_LP7c23WM?list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt`

Artificial Intelligence
B.Tech (20IT504/PE1A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Objectives:

The course aims to enable the students

- to describe the structure of artificial intelligence agents and their environments.
- to describe various search techniques for reaching goal state from initial state of a problem.
- to understand knowledge representation techniques like Predicate Logic, First-Order Logic and Slot-and-Filler Structures.
- to understand Goal Stack Planning algorithm.
- to understand learning techniques and expert systems.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the structure of artificial intelligence agents and their environments and various search techniques for finding a solution to a problem.

CO2 Represent knowledge and draw inferences using Predicate Logic, First-Order Logic and Slot-and-Filler Structures.

CO3 Solve planning problems using Goal Stack Planning algorithm.

CO4 Describe expert systems and different types of learning.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3

UNIT - I **(12 Hours)**

Introduction to AI: What is AI? , Foundations of AI, History of AI, State of the Art.
Intelligent Agents: Agents and Environments, Good Behavior: Concept of Rationality, The Nature of Environments And The Structure of Agents.
Solving Problems by Searching: Problem Solving Agents, Searching for Solutions.
Uninformed Search Strategies: Breadth First Search, Uniform Cost Search, Depth First Search, Iterative Deepening DFS and Bidirectional Search.
Informed (Heuristics) Search Strategies: Greedy BFS, A* Algorithm. AND OR search trees
Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Local Search in CSPs.

UNIT - II **(12 Hours)**

Logical Agents: Knowledge Based Agents, The Wumpus World, Logic and Propositional Logic.
Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and Backward chaining.
First Order Logic: Representation, Revisited Syntax and Semantics of First Order Logic, Using First Order Logic, Knowledge Engineering in First Order Logic.
Inferences in First Order Logic: Propositional vs. First Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT - III **(11 Hours)**

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.
Slot and Filler Structures: Semantic Nets, Conceptual Dependency, Scripts.
Planning: Overview - An Example Domain, The Blocks World, Component of Planning Systems, Goal Stack Planning, Hierarchical planning, Reactive systems.

UNIT - IV **(11 Hours)**

Learning: Introduction to learning, Rote learning, Learning by taking advice, Learning in problem solving, Learning from examples, Induction Learning, Explanation Based Learning.
Expert Systems: Representing and using domain knowledge, Expert system shells, Explanation, Knowledge Acquisition.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig. *Artificial Intelligence - A Modern Approach*. Pearson Education, 4 edition, 2020. ISBN 9780134671864
2. E Rich and K Knight. *Artificial Intelligence*. TMH, 2 edition, 2004. ISBN 0074600818

REFERENCES:

1. Patrick Henry Winston. *Artificial Intelligence*. Pearson, 3 edition, 2007. ISBN 8131715051
2. Saroj Kaushik. *Artificial Intelligence*. Cengage Learning, 1 edition, 2020. ISBN 9788131510995

ON-LINE RESOURCES:

1. Shyamanta M. Hazarika. *Introduction to AI*. IIT Guwahati, 2019. URL `https://youtu.be/pKeVMlkFpRc?list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH`

Digital Image Processing
B.Tech (20IT504/PE1B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

NIL

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the process of digital image formation and storage.

CO2 Describe the digital image processing techniques like Intensity Transformation & Spatial Filtering and Filtering in the Frequency Domain.

CO3 Describe image restoration process and color image processing.

CO4 Describe morphological image processing techniques.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	2	2	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	2	2	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	2	2	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	2	2	-	-	-	-	-	-	3	3	3	3

UNIT - I (11 Hours)

Introduction: What Is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, An introduction to the mathematical tools used in Digital Image Processing.

UNIT - II (12 Hours)

Intensity Transformations And Spatial Filtering: Background. Some Basic Intensity Transformation functions, Histogram Processing, Fundamentals of Spatial Filters, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Filtering In The Frequency Domain: Background, Extension to Functions of two variables, Some properties of 2D Discrete Fourier Transform, The basics of filtering in the Frequency Domain, Image

smoothing using frequency domain filters, Image sharpening using frequency domain filters, Selective filtering.

UNIT - III **(12 Hours)**

Image Restoration: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Geometric Mean Filter.

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Image Segmentation based on Color, Noise in Color Images, Color Image Compression.

UNIT - IV **(11 Hours)**

Image Compression: Fundamentals, Some basic compression Methods, Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run length coding, Symbol based coding, Bit plane coding, Block transform coding, Predictive coding.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and COsing, The Hit & Miss Transformation.

TEXT BOOKS:

1. R C Gonzalez and R E Woods. *Digital Image Processing*. Pearson Education Publishers, 4 edition, 2019. ISBN 9780321564085

REFERENCES:

1. S Jayaraman, S Esakkirajan, and T Veerakumar. *Digital Image Processing*. Mc-Grah Hill Publications, 1 edition, 2010. ISBN 9780321564085
2. Milan Sonka, Vaclav Hlavac, and Roger Boyle. *Image Processing Analysis and Machine Vision*. Thomson learning, 2 edition, 2001. ISBN 9780321564085
3. S.Sridhar. *Digital Image Processing*. Oxford University Press, 1 edition, 2016. ISBN 9780321564085

ON-LINE RESOURCES:

1. P.K.Biswas. *Digital Image Processing*. IIT Kharagpur, 2016. URL `https://youtu.be/DSGHkvQBMbs?list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8`

User Interface/User Experience Design
20IT504/PE1C

Lectures	:	3 Periods / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Objectives:

The course aims to enable the students

- to describe graphic design on screens, interface technologies.
- to describe user-centered design.
- to describe wire-framing and prototyping software in various UI/UX design tools.
- to describe usability testing methods.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe graphic design on screens, interface technologies.

CO2 Describe iterative user-centered design of graphical user interfaces.

CO3 Describe wire-framing and prototyping software in various UI/UX design tools.

CO4 Describe usability testing methods and post launch analysis methods.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 2	-	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 3	-	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 4	3	-	3	-	3	-	-	-	-	-	-	-	-	3	-

UNIT - I (15 Periods)

Introduction to the UI: What is User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual

Communication design component in Interface Design

UNIT - II **(15 Periods)**

Introduction to UX: UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience- Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design.

UNIT - III **(15 Periods)**

UI/ UX Design Tools: User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design.

UNIT - IV **(15 Periods)**

Design Testing with Users: Exploring Visual Design Mock-Ups, Choosing a Design Testing Approach, Qualitative Research vs Quantitative Research, In-Person Research vs Remote Research, Moderated Techniques vs Automated Techniques, Usability Testing, Planning the Research, Analyzing and Presenting Results, Visual Design, Development, and Quality Assurance, Postlaunch Activities.

TEXT BOOKS:

1. Jesse James Garrett. *The Elements of User Experience: User-Centered Design for the Web and Beyond*. Pearson Education, 2 edition, 2011
2. Russ Unger and Carolyn Chandler. *A Project Guide to UX Design: For user experience designers in the field or in the making*. New Riders Publishing, 2 edition, 2012

REFERENCES:

1. Wilbert O. Galitz. *The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques*. Wiley Publishing, 3 edition, 2007
2. Rex Hartson and Pardha S. Pyla. *The UX Book Process and Guidelines for Ensuring a Quality User Experience*. Elsevier, 2012

ON-LINE RESOURCES:

1. Saptarshi Kolay. *User Interface Design*. IIT Roorkee, 2018. URL `https://youtu.be/jLQauZP2e_4?list=PLLy_2iUCG87CEsW4KimdWPXEo80TaJfnP`

Mobile Application Development
B.Tech (20IT505/JO1A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Apply Java programming concepts to Android App development

CO2 Develop User interfaces for Android Apps

CO3 Develop mobile apps using database, notification and services

CO4 Use the mobile sensors, google maps & multimedia in Mobile Apps

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	3	-	-	-	-	-	-	3	3	2	2
CO 2	3	3	3	-	3	-	-	-	-	-	-	3	3	2	2
CO 3	3	3	3	-	3	-	-	-	-	-	-	3	3	2	2
CO 4	3	3	3	-	3	-	-	-	-	-	-	3	3	2	2

UNIT - I (11 Hours)

Introduction:- ANDROID: AN OPEN PLATFORM FOR MOBILE DEVELOPMENT, Android SDK Features, Introducing the Development Framework.
Getting Started:- What You Need to Begin, Creating Your First Android Application, Types of Android Applications.

UNIT - II (12 Hours)

Creating Applications and Activities:- What Makes an Android Application?, Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A COser Look at Android Activities, Creating Activities, The Activity Lifecycle, Activity States.
Building User Interfaces:- Fundamental Android UI Design, Android User Interface Fundamentals, Introducing Layouts, Introducing Fragments.

UNIT - III (12 Hours)

Intents and Broadcast Receivers:- Introducing Intents, Creating Intent Filters and Broadcast Receivers.
Saving State and Preferences:- Creating and Saving Shared Preferences , Retrieving Shared Preferences Persisting the Application Instance State.

UNIT - IV **(11 Hours)**

Databases and Content Providers:- Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases, Creating Content Providers, Using Content Providers
Working in the Background:- Creating and Controlling Services, Binding Services to Activities
Expanding the User Experience:- Introducing the Action Bar ,Creating and Using Menus and Action Bar Action Items

TEXT BOOKS:

1. Reto Meier, John Wiley, and Sons. *Professional Android 4 Application Development*. John Wiley and Sons, Inc., 1 edition, 2012. ISBN 9780321564085

REFERENCES:

1. Brian Hardy, Bill Phillips, and Big Nerd Ranch. *Android Programming The Big Nerd Ranch Guide*. O'REILLY, 5 edition, 2022. ISBN 9780321564085
2. Brian Hardy, Bill Phillips, and Big Nerd Ranch. *Android Programming The Big Nerd Ranch Guide*. O'REILLY, 5 edition, 2022. ISBN 9780321564085

Robotic Process Automation
B.Tech (20IT505/JO1B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe RPA and its applications

CO2 Describe the basic features of UIPath

CO3 Describe the advanced features of UIPath

CO4 Describe the process to handle exceptions and events in UIPath

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 3	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3

UNIT - I (11 Hours)

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do? Benefits of RPA, Components of RPA, RPA platforms, The future of automation. RPA BASICS: History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

UNIT - II (12 Hours)

RPA TOOL INTRODUCTION AND BASICS : Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity -

The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

UNIT - III **(12 Hours)**

ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT - IV **(11 Hours)**

HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event.

EXCEPTION HANDLING: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

TEXT BOOKS:

1. Alok Mani Tripathi. *Learning Robotic Process Automation*. Packt, 2018

REFERENCES:

1. Heidi Jaynes Lauren Livingston Frank Casale, Rebecca Dilla. *Introduction to Robotic Process Automation: a Primer*. Institute of Robotic Process Automation, 1 edition, 2015
2. Richard Murdoch. *Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks and Become An RPA Consultant*. Independently Published, 1 edition, 2018
3. Srikanth Merianda. *Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation*. Consulting Opportunity Holdings LLC, 1 edition, 2018
4.

Computer Animation and Game Design
B.Tech (20IT505/JO1C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Object Oriented Programing (20IT303).

Course Objectives:

The course aims to enable the students

- to develop 3D models and animation them along a path with Maya.
- to develop 3D models using Z-Brush.
- to develop 2D game in Unity.
- to develop 3D game.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop 3D models and animation them along a path with Maya.

CO2 Develop 3D models using Z-Brush.

CO3 Develop 2D game in Unity.

CO4 develop 3D game.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 2	-	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 3	-	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 4	3	-	3	-	3	-	-	-	-	-	-	-	-	3	-

UNIT - I **(11 Hours)**

3D model creation and animation in Maya: Basic tools in maya,3D model creation with polygons, 3D model creation with NURBS surfaces, Animate 3D objects,create 3D model of human and Walk cycle animation.

List of Experiments

1. Build a spaceship with polygons in maya.
2. Build a spaceship with NURBS surfaces in maya.
3. Application of texture to the spaceship.
4. Animate poly spaceship and NURBS spaceaship along various path.
5. Build a 3D model of human, add IK chains for controlling the movement of hands and legs.
6. Animate the walk cycle of primitive man in maya.

UNIT - II **(12 Hours)**

3D model creation in Z-Brush: Introduction to Z-Brush modeling, creating a video game character, creating a photo real character, creating a Hyper real character .

List of Experiments

1. Export a 3D model from maya (.fbx file).
2. Export a model from Z-Brush to Maya.
3. Create a video game character in Z-Brush.
4. Create a Hyper real character in Z-Brush.
5. Create a Photo real character in Z-Brush.

UNIT - III **(12 Hours)**

2D game development with unity 2D assets for unity, Sprite sheets and animating sprites, creating and scripting health bar, wander algorithm, ammo script .

List of Experiments

1. Create a sprite sheet and its animation in unity.
2. Creation of basic transformation in unity using c# script.
3. Building health bar and control values on it with c# script.
4. Experiment with canvas object- creation of text box, buttons and control them with c# script.
5. Experiment with onCollisionEnter2D() and onCollisionExit2D() methods in unity.
6. Controlling transitions in animator based on boolean and float variables.
7. implement camera following in unity with c# script.

UNIT - IV **(11 Hours)**

3D game development in unity: Importing 3D models and animations, animated materials, Developing the state machine, start building a game and get the basic structure running, Moving around, collisions and keeping score.

List of Experiments

1. Creation of animated materials in unity.
2. import 3D model into unity from maya.
3. Creation of 3D game in unity with multiple states.

TEXT BOOKS:

1. Robert Magee Bob Gundu. *Learning Maya, Don Chong, Bruce Darrell*. Alias|Wavefront- a division of Silicon Graphics Limited
2. Jason Patnode. *Character Modeling with Maya and ZBrush- Professional Polygonal Modeling Techniques*. focal press, 2008
3. Jared Halpern. *Developing 2D Games with Unity: Independent Game Programming with C#*. Apress, 2019
4. Terry Norton. *Learning C# by Developing Games with Unity 3D Beginner's Guide*. PACKT publishing

REFERENCES:

1. Claudio Scolastici. *Unity 2D Game Development Cookbook*. PACKT publishing, 2015
2. Lee Lanier. *Maya- Professional Tips and Techniques*. Wiley Publishing, 2008
3. John Edgar Park. *Understanding 3D Animation using Maya*. Springer
4. Jeff W Murray. *C# Game Programming Cookbook for Unity 3D*. CRC press
5. Alan Thorn. *Learn Unity for 2D Game Development*. Apress, 2015

Soft Skills Lab

(Common to all branches)

B.Tech – V Semester (20ITL501/SO03)

Lectures	:	1 Hours / Week	Tutorial	:	0	Practical	:	2
CIA Marks	:	30	SEE Marks	:	70	Credits	:	2

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Use appropriate body language in Social and Professional contexts.

CO2 Demonstrate different strategies in presenting themselves in professional contexts.

CO3 Analyze and develop their own strategies of facing the interviews successfully.

CO4 Develop team coordinating skills as well as leadership qualities.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	-	-	-	-	-	-	-	2	3	3	2	2	-	-	-
CO2	-	-	-	-	-	-	-	2	3	3	2	2	-	-	-
CO3	-	-	-	-	-	-	-	2	3	3	2	2	-	-	-
CO4	-	-	-	-	-	-	-	2	3	3	2	2	-	-	-

UNIT - I (11 Hours)

Body Language & Identity Management: Facial Expressions – Kinesics - Occulesics, Haptics - Proxemics, Para Linguistics, Appearance, Identity Management Communication

UNIT - II (12 Hours)

Emotional Intelligence & Life Skills: Self Awareness through Johari Window and SWOC analysis, Self Motivation, Empathy, Assertiveness & Managing Stress, Positive Attitude, Time Management.
Goal Setting: Short term, Long Term, Vision, Mission.

UNIT - III (12 Hours)

Business Presentations: Preparing effective Presentations Power Point Presentations, Power Point Presentations, Using Visual Aids, Mock Presentations.

UNIT - IV (11 Hours)

Employability Skills: Group Discussion, Team Building and Leadership Qualities, Interview Skills.

REFERENCES:

1. Barun K. Mithra. *Personality Development and Soft skills*. Oxford University Press, 2 edition, 2016. ISBN 9780321564085
2. Allan and Barbara. *The Definitive Book of Body Language*. Pease International, 1 edition, 2004. ISBN 9780321564085
3. Daniel Goleman. *Working with Emotional Intelligence*. Bloomsbury, 1 edition, 1998. ISBN 9780321564085
4. Lina Mukhopadhyay. *English for Jobseekers*. Cambridge University Press, 1 edition, 2013. ISBN 9780321564085
5. Stephen R. Covey. *The 7 Habits of Highly Effective People*. St. Martin's Press, 1 edition, 2014. ISBN 9780321564085

Software Engineering Lab
B.Tech – V Semester (20ITL502/CC17)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Prepare software requirement specification (SRS) document for suggested system

CO2 Design analysis model using Use case, Class and Object UML diagrams.

CO3 Design behavioural model using Interaction, State-chart and Activity UML diagrams.

CO4 Design implementation and environment view models using Component and Deployment UML diagrams.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3

List of Experiments

1. Write down the problem statement for a suggested system of relevance.
2. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart.
4. To perform the user‘s view analysis for the suggested system: Use case diagram.
5. To draw the structural view diagram for the system: Class diagram, object diagram.
6. To draw the behavioral view diagram : State-chart diagram, Activity diagram
7. To perform the behavioral view diagram for the suggested system : Sequence diagram, Collaboration diagram
8. To perform the implementation view diagram: Component diagram for the system.
9. To perform the environmental view diagram: Deployment diagram for the system.

10. To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system.

Choose any one of the following projects and do any 8 of the above exercises for that project

1. Student Result Management System
2. Library management system
3. Inventory control system
4. Accounting system
5. Fast food billing system
6. Bank loan system
7. Blood bank system
8. Railway reservation system
9. Automatic teller machine
10. Video library management system
11. Hotel management system
12. Hostel management system
13. E-ticking
14. Share online trading
15. Hostel management system
16. Resource management system
17. Court case management system

Mobile Application Development Lab
B.Tech (20ITL503/JOL1A)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Design Android applications to demonstrate Basic Views, Layout and Fragments in Android.

CO2 Develop Android applications using Intents, Broadcast Receivers

CO3 Design Android applications using SQLite database

CO4 Design Android applications using background Services

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	3	2	-	3	2	3	3
CO 2	3	3	3	3	3	-	-	-	3	2	-	3	2	3	3
CO 3	3	3	3	3	3	-	-	-	3	2	-	3	2	3	3
CO 4	3	3	3	2	3	-	-	-	3	2	-	3	2	3	3

List of Experiments

1. Design an application to demonstrate the temperature conversion in Android.
2. Design an application to demonstrate student registration form using event handling.
3. Design an application to demonstrate layouts in Android.
4. Design an application to demonstrate fragments in Android.
5. Design an application to demonstrate explicit intent in Android.
6. Design an application to demonstrate implicit intent in Android.
7. Design an application to demonstrate broadcast receiver in Android.
8. Design an application to demonstrate Shared Preferences in Android.
9. Design an application to demonstrate SQLite database in Android.
10. Design an application to demonstrate Content Providers in Android.
11. Design an application to demonstrate Services in Android.
12. Design an application to demonstrate Menus in Android.

TEXT BOOKS:

1. Reto Meier, John Wiley, and Sons. *Professional Android 4 Application Development*. John Wiley and Sons, Inc., 1 edition, 2012. ISBN 9780321564085

REFERENCES:

1. Brian Hardy, Bill Phillips, and Big Nerd Ranch. *Android Programming The Big Nerd Ranch Guide*. O'REILLY, 5 edition, 2022. ISBN 9780321564085

Essence of Indian Traditional Knowledge

(Common to all branches)

B.Tech – V Semester (20IT506/MC03)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	00	Credits	:	0

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the concept of traditional knowledge and its importance

CO2 Explain traditional production, history of science and vaastu

CO3 Explain origins of mathematics, astronomy and astrology in the TKS

CO4 Describe the concept of Yoga and its correlations to science

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	-	-	-	-	-	2	2	2	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	2	2	2	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	2	2	2	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	2	2	2	-	-	-	-	-	-	-

UNIT - I (7 Hours)

Historical Background: TKS during the Pre-colonial and Colonial Period

Indian Traditional Knowledge System

Traditional Medicine: Ayurveda, Simple Definition, Origin, Texts, The Great Three Classics of Ayurveda, The Lesser Three Classics of Ayurveda, The Branches of Ayurveda, Basic Concepts of Ayurveda, Purusha/Prakruti, Manifestation of Creation, Space, Air, Fire, Water, Earth, Mental Constitution, Satvic Mental Constitutions, Rajasic Mental Constitutions, Tamasic Mental Constitutions, Vata, Pitta and Kapha: The Three Doshas

UNIT - II (8 Hours)

Traditional Production and Construction Technology: Social Conditions and Technological Progress, The Impetus for Metallurgy, Social Needs and Technological Applications, Scientific Rationalism and Technological Efficacy, Cultural Mores and Technological Innovation, State Support of Technology,

Limitations of Pre-Industrial Manufacturing, India and the Industrial Revolution.
History of Physics and Chemistry: Philosophy and Physical Science, Particle Physics, Optics and Sound, Astronomy and Physics, The Laws of Motion, Experimentation versus Intuition, The Social Milieu, The Five Basic Physical Elements, Indian Ideas about Atomic Physics.
Traditional Art and Architecture and Vastu Shashtra: Vastu, The Principles of Vastu are Simple.

UNIT - III **(8 Hours)**

Origin of Mathematics
Astronomy and Astrology
TKS and the Indian Union: Protection and the Legislative Frameworks in India, Comment, Sui Generis System, Trade Secrets and Know-how, Geographical Indications Bill, Protection of Plan varieties and Farmers Rights Bill, Rights of Communities, Monitoring Information on Patent Applications World-wide, Frameworks for Supporting R&D Activities in the Area of TKS.

UNIT - IV **(7 Hours)**

Common Yoga Protocol: Introduction, What is Yoga? Brief History and Development of Yoga, The fundamentals of Yoga, Traditional Schools of Yoga, Yogic practices for health and wellness General Guidelines for Yoga Practice: Before the practice, During the Practice, After the Practice, Food for Thought, How Yoga can Help.

1. Invocation
2. Sadilaja/Cālana Kriyās /Loosening Practices,
3. Yogāsanas:
    - Standing Postures: Tāḍāsana (Palm Tree Posture), Vṛkṣāsana (The Tree Posture), Pāda-Hastāsana (The Hands to Feet Posture), Ardha Cakrāsana (The Half Wheel Posture), Trikonāsana (The Triangle Posture)
    - Sitting Postures: Bhadrāsana (The Firm/Auspicious Posture), Vajrāsana (Thunderbolt Posture), Uṣṭrāsana (Camel Posture), Śaśakāsana (The Hare Posture), Vakrāsana (The Spinal Twist Posture),
    - Prone Postures: Makarāsana (The Crocodile Posture), Bhujaṅgāsana (The Cobra Posture), Śalabhāsana (The Locust Posture),
    - Supine Postures: Setubandhāsana (The Bridge Posture), Uttāna Pādāsana (Raised feet posture), Pavana Muktāsana (The Wind Releasing Posture), Śavāsana (The Corpse/ Dead Body Posture)
4. Kapālabhāti
5. Prānāyāma: naḍīśodhana or anuloma viloma prānāyāma (Alternate Nostril Breathing), Śītalī Prāṇāyāma, Bhrāmarī Prāṇāyāma (Bhrāmarī Recaka)
6. Dhyāna
7. Sankalpa
8. Śantih pātha

TEXT BOOKS:

1. Amit Jha. *Traditional Knowledge System in India*. Pearson, 1 edition, 2009. ISBN 9780321564085
2. Ministry of Ayush. *Common YOGA Protocol*. Ministry of Ayush, 1 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Basanta Kumar Mohanta and Vipin Kumar Singh. *Traditional Knowledge System and Technology in India*. Pearson, 1 edition, 2012. ISBN 9780321564085

Compiler Design

(Common to CSE & IT)

B.Tech – VI Semester (20IT601/CC18)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Automata Theory & Formal Languages (20IT501)

Course Objectives:

The course aims to enable the students

- to comprehend the principles involved in the design and construction of compilers, the algorithms involved in the design and construction of compilers, Understand the design of lexical analyzer.
- to familiarize with bottom up parsing techniques.
- to apply Various intermediate languages to understand code generation algorithm
- to understand storage allocation strategies and Symbol table data structures.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Explain the phases of a compiler and roles of lexical & syntax analyzers

CO2 Compute different bottom-up parsing methods

CO3 Describe a number of intermediate languages with respect to the code generation algorithm

CO4 Discuss the Various storage allocation strategies and symbol table concepts.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 2	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 3	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2

UNIT - I **(11 Hours)**

Introduction: Language Processors, The Structure of a Compiler.

Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator LEX.

Syntax Analysis: Introduction, Writing a Grammar: elimination of left recursion, left factoring, Top-Down Parsing: Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Non recursive Predictive Parsing.

UNIT - II **(12 Hours)**

Bottom-Up Parsing: Introduction to LR Parsing: Simple LR, More Powerful LR Parsers: Canonical LR(1) Items, Constructing LR(1) Sets of Items, Canonical LR(1) Parsing Tables, Constructing LALR Parsing table. The Parser Generator YACC.

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Construction of syntax trees.

UNIT - III **(12 Hours)**

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address codes, Translation of expressions: Operations within expressions, Incremental translation, control flow: Boolean expressions: Short circuited code Flow of control statements, Control flow translation of Boolean expressions, Back patching for Boolean Expressions.

Code Generation: Issues in the Design of a Code Generator, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator

UNIT - IV **(12 Hours)**

Runtime Environment: Storage Organization, Static allocation strategy, Stack Allocation of Space: Activation trees, Activation records, calling sequence, variable length data on the stack.

Symbol Tables: Symbol table entries, Data structures to symbol tables, representing scope information.

TEXT BOOKS:

1. Alfred V Aho, RaviSethi, and JD Ullman. *Compilers Principles, Techniques and Tools*. Pearson, 2 edition, 2013. ISBN 9789332518667

REFERENCES:

1. Alfred V Aho and Jeffrey D Ullman. *Principles of Compiler Design*. Narosa, 1 edition, 2002. ISBN 9788185015613
2. John R Levine, Tony Mason, and Doug Brown. *Lex and YACC*. Oreilly, 1 edition, 2004. ISBN 9781565920002
3. Andrew N Appel. *Modern Compiler Implementation in C*. Cambridge University Press, 1 edition, 2004. ISBN 9788175960718

ON-LINE RESOURCES:

1. Santanu Chattopadhayay. *Compiler Design*. IIT Madras, 2018. URL

https://youtu.be/_ck1Lnm28hQ?list=PLbRMhDVUMngcseCW7wXDvtTDemCuH80fP

Machine Learning

(Common to CSE & IT)

B.Tech – VI Semester (20IT602/CC19)

Lectures	:	2 Hours / Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

None

Course Objectives:

The course aims to enable the students

1. to understand a Linear, Polynomial, Ridge and Lasso regression models.
2. to comprehend a Supervised Learning Model.
3. to understand Ensemble methods for improving the performance of a Learning Model.
4. to describe the K-Means, Hierarchical and Gaussian Mixture Model clustering methods.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe the steps, applications and challenges involved in building Linear, Polynomial, Ridge and Lasso regression models.

CO2 Describe the steps, applications and challenges involved in building Generative and Discriminative Classifiers.

CO3 Describe the ensemble methods Bagging, Pasting and Boosting for building strong classifiers.

CO4 Describe the K-Means, Hierarchical and Gaussian Mixture Model clustering methods. algorithms.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

UNIT - I **(12 Hours)**

Machine learning basics: What is machine learning?, Key terminology, Types of Machine Learning Systems, How to choose the right algorithm, Steps in developing a machine learning application, Main Challenges of Machine Learning Essential Python Libraries: Scikit-learn, NumPy, matplotlib, Pandas. A First Application: Classifying iris species using Sci-kit learn.

Linear Regression: Simple linear regression. Optimization of model parameters using Batch gradient decent algorithm, Mini batch gradient decent algorithm and Stochastic gradient descent algorithm, Multiple linear regression, Locally weighted linear regression, Polynomial Regression. Regularized Linear Models- Ridge Regression and Lasso Regression

Regularization: Bios Variance tradeoff, L1 and L2 regularization.

UNIT - II **(12 Hours)**

Generative Classifiers: Classifying with Bayesian decision theory, Bayes' rule, Naïve Bayes classifier.

Discriminative Classifiers: Logistic Regression, Decision Trees: Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Attribute selection measures- Gini impurity; Entropy, Regularization Hyperparameters, Regression Trees, Linear Support vector machines.

UNIT - III **(12 Hours)**

Evaluation of a Classifier: Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Trade-off, The ROC Curve.

Ensemble Learning: Voting Classifiers, Bagging and Pasting, Random Forests, Boosting- AdaBoost and Gradient Boosting.

UNIT - IV **(11 Hours)**

Computational Learning Theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis spaces.

Unsupervised Learning: K-means clustering algorithm, Hierarchical clustering algorithm, Gaussian mixture model.

TEXT BOOKS:

1. Aurelien Geron. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly publishers, 2 edition, 2019a. ISBN 9781492032649
2. Peter Harrington. *Machine Learning in Action*. Manning, 1 edition, 2012. ISBN 9781617290183

REFERENCES:

1. Andrew Ng. *Machine Learning Lecture Notes*. Stanford University. URL `https://see.stanford.edu/Course/CS229`
2. Sebastian Raschka and Vahid Mirjalili. *Python Machine Learning*. Packt Publishing, 2 edition, 2017. ISBN 9789352136278

3. Andreas C. Müller and Sarah Guido. *Introduction to Machine Learning with Python*. Oreilly, 1 edition, 2016. ISBN 9781449369415

4. Tom M. Mitchell. *Machine Learning*. Mc.Graw Hill, 1 edition, 1997. ISBN 0070428077. URL `http://www.cs.cmu.edu/~tom/mlbook.html`

ON-LINE RESOURCES:

1. Sudeshna Sarkar. *Machine Learning*. IIT Kharagpur, 2016. URL `https://youtu.be/T3PsRW6wZSY?list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC`

Cryptography and Network Security

(Common to CSE & IT)

B.Tech – VI Semester (20IT603/CC20)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Computer Networks (20IT502)

Course Objectives:

The course aims to enable the students

- to understand security services, attacks and various encryption techniques.
- to understand the concepts of public key cryptography, message authentication and hash functions.
- to understand the digital signature, key management and email security mechanisms.
- to gain knowledge on Transport layer & Network layer security

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe various security goals, attacks and security mechanisms

CO2 Illustrate different cryptographic algorithms and authentication functions

CO3 Describe the process of generating digital signature and key generation algorithms.

CO4 Describe the process of providing security at network and transport layers.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3

UNIT - I **(11 Hours)**

Introduction: Security Goals, Attacks, Service and Mechanism, Techniques
Traditional symmetric key ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers
Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES
Encipherment using Modern Symmetric Key Ciphers: Use of Modern Block Ciphers

UNIT - II **(12 Hours)**

Advanced Encryption Standard: Introduction, Transformations, Key Expansion, Ciphers.
Asymmetric Key Cryptography: Introduction, RSA Cryptosystem, Robin Cryptosystem, Elgamal Cryptosystem.
Message Integrity and Message Authentication: Message Integrity, Message Authentication.
Cryptographic Hash Functions: Introduction, SHA-512.

UNIT - III **(12 Hours)**

Digital Signatures: Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Standard.
Key Management: symmetric key distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution.
Security at the Application Layer: E-Mail, PGP.

UNIT - IV **(11 Hours)**

Security at the Transport Layer: SSL Architecture, Four Protocols, SSL Message Format, Transport Layer Security.
Security at the Network Layer: Two Modes, Two Security Protocols, Security Association, Security Policy, Internet Key Exchange, ISAKMP.

TEXT BOOKS:

1. Behrouz A. Forouzan. *Cryptography and Network Security*. Mc Graw Hill, 3 edition, 2015. ISBN 9789339220945

REFERENCES:

1. William Stallings. *Cryptography and Network Security*. Pearson Education, 4 edition, 2005. ISBN 9780131873162
2. Kaufman, Perlman, and Speciner. *Network Security*. PHI, 2 edition, 2012. ISBN 8120322134
3. Trappe and Washington. *Introduction to Cryptography with Coding Theory*. Pearson, 2 edition, 2005. ISBN 9780131862395

ON-LINE RESOURCES:

1. Dr.Ashish Chudhary. *Foundations of Cryptography*. Indian Institute of Science, Bengaluru, 2019. URL `https://youtu.be/eIJzIUhks6E`

Data Warehousing & Data Mining
B.Tech (20IT604/PE2A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Database Management Systems (20IT403)

Course Objectives:

The course aims to enable the students

- understand the significance and steps involved in data ware housing and data mining.
- describe the steps involved in data pre-processing and in developing a classifier model.
- describe the process of frequent pattern mining, association rule mining and correlation analysis among items.
- describe the principles of Partitioning, Hierarchical, Density and Grid based clustering methods.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the significance and steps involved in data ware housing and data mining.

CO2 Describe the steps involved in data pre-processing and in developing a classifier model.

CO3 Describe the process of frequent pattern mining, association rule mining and correlation analysis among items.

CO4 Describe the principles of Partitioning, Hierarchical, Density and Grid based clustering methods.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

UNIT - I **(11 Hours)**

Data Warehouse and OLAP Technology: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation from Data Warehousing to Data Mining.

Data Mining: Introduction, Kinds of Data, Data Mining Functionalities, Classification of DataMining Systems, Major Issues in Data Mining.

UNIT - II **(12 Hours)**

Data Pre-processing: Importance of Data Process, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Classification and Prediction: Introduction to Classification and Prediction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction - Decision Tree Induction, Attribute Selection Measures, Bayesian Classification.

UNIT - III **(12 Hours)**

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map, Efficient and Scalable Frequent Item-set Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT - IV **(12 Hours)**

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods- k-Means and k-Medoids, Hierarchical Methods- Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods- DBSCAN, Grid Based Methods- STING, Outlier Analysis.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber. *Data Mining Concepts and Techniques*. Morgan Kaufmann Publishers, 3 edition, 2007. ISBN 9789380931913

REFERENCES:

1. Pang Ning Tan, Michael Steinbach, Anuj Karpatne, and Vipin Kumar. *Introduction to Data Mining*. Pearson Education, 2 edition, 2021. ISBN 9789354491047
2. Margaret H. Dunham. *Data Mining (Introductory and Advanced Topics)*. Pearson Education, 1 edition, 2006. ISBN 9780321564085

Protocols for Secure Electronic Commerce

B.Tech (20IT604/PE2C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

NIL

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the impact of E-commerce on business models and strategies and E-marketing strategies and digital payment.

CO2 Describe E-marketing tools and E-Business entrepreneurship and Business Incubators.

CO3 Describe SSL,TSL protocols.

CO4 Describe the frame work and anatomy of money and payment systems.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	2	3	-	-	3	-	-	2	-	-	-	2	2	2	2
CO 2	2	3	2	-	3	-	-	2	-	-	-	2	2	3	3
CO 3	2	3	2	-	3	-	-	2	-	-	-	2	3	3	3
CO 4	2	3	2	-	3	-	-	2	-	-	1	2	3	3	3

UNIT - I (11 Hours)

Overview of Electronic Commerce:- What Is Electronic Commerce, Categories of Electronic Commerce, The Influence of the Internet, Infrastructure for Electronic Commerce, Network Access, Consequences of E-Commerce, Summary.

Money and Payment Systems:- The Mechanisms of Classical Money, Instruments of Payment, Types of Dematerialized Monies, Purses and Holders, Transactional Properties of Dematerialized Currencies, Overall Comparison of the Means of Payment, The Practice of Dematerialized Money, Banking Clearance and Settlement, Summary.

UNIT - II (12 Hours)

Algorithms and Architectures for Security:- Security of Commercial Transactions, Security of Open Financial Networks, Security Objectives, OSI Model for Cryptographic Security, Security Services at the Link Layer, Security Services at the Network Layer, Security Services at the Application Layer, Message Confidentiality, Data Integrity, Identification of the Participants, Authentication of the

Participants, Access Control, Denial of Service, Nonrepudiation, Secure Management of Cryptographic Keys, Exchange of Secret Keys: Kerberos, Public Key Kerberos, Exchange of Public Keys, ISAKMP (Internet Security Association and Key Management Protocol), SKIP (Simple Key Management for Internet Protocols), Key Exchange Algorithm, Certificate Management, Encryption Cracks, Summary.

Business-to-Business Commerce:- Overview of Business-to-Business Commerce, Examples of Business-to-Business Electronic Commerce, Business-to-Business Electronic Commerce Platforms, Obstacles Facing Business-to-Business Electronic Commerce, Business-to-Business Electronic Commerce Systems, Structured Alphanumeric Data, Structured Documents or Forms, EDI Messaging, Security of EDI, Relation of EDI with Electronic Funds Transfer, Electronic Billing, EDI Integration with Business Processes, Standardization of the Exchanges of Business-to-Business Electronic Commerce, Summary.

UNIT - III **(12 Hours)**

SSL (Secure Sockets Layer):- General Presentation of the SSL Protocol, SSL Subprotocols, Example of SSL Processing, Performance Acceleration, Implementations, Summary.

TLS (Transport Layer Security) and WTLS (Wireless Transport Layer Security):- From SSL to TLS, WTLS, Summary.

The SET Protocol:- SET Architecture, Security Services of SET, Certification, Purchasing Transaction, Optional Procedures in SET, SET Implementations, Evaluation, Summary.

UNIT - IV **(11 Hours)**

Composite Solutions:- C-SET and Cyber-COMM, Hybrid SSL/SET Architecture, 3-D Secure, Payments with CD-ROM, Summary.

Micropayments and Face-to-Face Commerce:- Characteristics of Micropayment Systems, Potential Applications, Chipper, GeldKarte, Mondex, Proton, Harmonization of Electronic Purses, Summary.

Remote Micropayments:- Security without Encryption: First Virtual, NetBill, KLELine, Millicent, PayWord, MicroMint, eCoin, Comparison of the Different First-Generation Remote Micropayment Systems, Second-Generation Systems, Summary.

TEXT BOOKS:

1. Mostafa Hashem Sherif. *Protocols for Secure Electronic Commerce*. CRC PRESS, 1 edition, 2000. ISBN 9780321564085

Enterprise Programming
B.Tech (20IT605/JO2A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Object Oriented Programming(20IT303), Web Technologies(20IT402)

Course Objectives:

The course aims to enable the students

- to develop an application using servlets and JDBC.
- to design an application using JSP and JSF.
- to create an application on web services and web sockets.
- to code an enterprise application using EJBs and Persistence API.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop Java EE applications using JDBC and Java Servlets following the HTTP protocol.

CO2 Develop dynamic, interactive web applications using JSP and JSF.

CO3 Develop Web Service and Web Socket applications

CO4 Develop enterprise applications using EJB

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3

UNIT - I **(12 Hours)**

Introduction : Java EE Architecture, The Many Variations of Java EE Applications, Packaging and Deploying the Java EE Application, Java EE Platform and Implementations.

Java Data Base Connectivity(JDBC): Introduction to JDBC, Structured Query Language, The JDBC APIs.

Java Servlets and Web Applications - Foundations of the Web Tier: The HTTP Protocol, Introducing Java Servlets, Understanding the Java Servlet API, Web Applications, Java Servlets: The Good and the Bad.

UNIT - II **(12 Hours)**

Dynamic Web Pages - JSP: JSP Runtime Architecture, JSP Syntax, The Java Environment for JSPs, JSP Standard Tags, Custom Tag Libraries, Expression Language.

Assembling Dynamic Web Pages - JavaServer Faces: Architecture of a JSF Application, JavaServer Faces Tags, Java EE Managed Beans, f: Core Tags, JSTL Core Tags, Extensibility and Modularity.

UNIT - III **(12 Hours)**

Web Sites for Non-browsers - JAX-RS: What Are RESTful Web Services, The Java API for RESTful Web Services, Deploying JAX-RS Resources, Content Production, Content Consumption, Accessing Web Service Context, Exception Mapping, Number of Instances of Resource Classes, Path Mapping.

JSON Processing: Streaming API : Consuming JSON Using the Streaming API, Producing JSON Using the Streaming API; **Object Model API :** Consuming JSON Using the Object Model API , Producing JSON Using the Object Model API.

Java WebSockets: Introduction to the WebSocket Protocol, The WebSocket Lifecycle, Overview of the Java WebSocket API, Java WebSocket Encoders and Decoders, Message Processing Modes, Path Mapping, Deployment of Server Endpoints.

UNIT - IV **(12 Hours)**

The Fundamentals of Enterprise Beans: Introduction to Enterprise Beans, Types of Enterprise Beans, Exposing Enterprise Beans, Finding Enterprise Beans, EJB Lifecycle, Packaging Enterprise Beans.

Advanced Thinking with Enterprise Beans: Multi-threading and Enterprise Beans, Asynchronous Enterprise Beans, Enterprise Bean Contexts, The Timer Service, Transactions and Enterprise Beans, Interceptors.

The Java Persistence API: Persistence Entities, The Entity Manager, Java Persistence Query Language, Configuring JPA Applications.

TEXT BOOKS:

1. Dr. Danny Coward. *Java EE 7: The Big Picture*. Oracle press, 7 edition, 2014. ISBN 9780071837330
2. Arun Gupta. *Java EE 7 Essentials*. O'Reilly, 7 edition, 2013. ISBN 9781449370176

REFERENCES:

1. Antonio Goncalves. *Beginning Java EE 7*. Apress, 7 edition, 2013. ISBN 9781430246268

Middleware Technologies
B.Tech (20IT605/JO2B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Interpret the operations of HTML & Web controls with tracing

CO2 Implement styles using validation controls and rich controls by applying state management

CO3 Operate the database with ADO.NET fundamentals and format the data with data controls

CO4 Describe framework, working with web services by following MVC

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3

UNIT - I (12 Hours)

The .NET Framework: C#, VB, and the .NET Languages, Intermediate languages, Common language runtime, the .NET class library.
Elements of C#: The C# keywords, Identifiers, Data Types, Literals, Variables, Operators & Program Control Statements.
Arrays and Strings: Arrays, Multidimensional Arrays, Jagged Arrays, Assigning Array References, Using the Length Property, Implicitly Typed Arrays, the foreach Loop, Exploring String Class Methods.
Introducing Classes and Objects: Class Fundamentals, How Objects Are Created, Reference Variables and Assignment, Methods, Constructors, the new Operator Revisited, Garbage Collection and Destructors, this Keyword.
A COser Look at Methods and Classes: Controlling Access to Class Members, Pass References to Methods, Use ref and out Parameters, Use a Variable Number of Arguments, Return Objects, Method Overloading, Overload Constructors, Object Initializers, Optional Arguments, Named Arguments, The Main() Method, Recursion, Understanding static, Static Classes, Properties.

UNIT - II (12 Hours)

Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Inheritance and Name Hiding, Creating a Multilevel Hierarchy, When Are Constructors Called, Base Class References and Derived Objects, Virtual Methods and Overriding, Applying Virtual Methods,

Using Abstract Classes.
Interfaces: Interfaces, Implementing Interfaces.
Exception Handling: Exception-Handling Fundamentals, A simple exception example using following keywords: try, catch, finally and throw.
Delegates & Events: Delegates, Events-Delegates, Events, Namespaces.

UNIT - III **(12 Hours)**

Web Form Fundamentals: Understanding the anatomy of an ASP.NET application, Introducing server controls, improving the currency converter, taking a deeper Look at HTML control classes, using the page class, using Application events.
Web Controls: Stepping up to web controls, web control classes, List controls, Table controls, Web control events and AutoPostBack, An interactive web page.
State Management: Understanding the problem of the state, using View State, Transferring information between pages, using cookies, managing session state, Configuring session state, using application state.
Validation: Understanding the validation, using the validation controls.

UNIT - IV **(12 Hours)**

ADO.NET Fundamentals: Understanding databases, configuring your database, Understanding SQL basics, Understanding the data provider model, using direct data Access, using disconnected data access.
Data Binding: Introducing data binding, using single valued data binding, using repeated value data binding, working with data source controls.
The Data Controls: The grid view, formatting the gridview, selecting a grid view row, Editing with a grid view row, sorting and paging in gridview, using grid view templates, The details view and form view.

TEXT BOOKS:

1. Herbert Schildt. *C# 4.0 The Complete Reference*. Tata McGraw Hill, 1 edition, 2010. ISBN 9780321564085
2. Matthew MacDonald. *Beginning ASP.NET 4.5 in C#*. Apress Publishing Company, 1 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Ian Griffiths. *Programming C# 5.0*. O'REILLY, 1 edition, 2012. ISBN 9780321564085
2. Jesse Liberty. *Programming C#*. O'REILLY, 2 edition, 2002. ISBN 9780321564085
3. Jesse Liberty and Donald Xie. *Programming C# 3.0*. O'Reilly, 5 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Sudip Misra. *Introduction to Industry 4.0 and Industrial Internet of Things*. IIT Kharagpur, 2018. URL `https://youtu.be/p7kYStiASLo?list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR`

Industrial Internet of Things
B.Tech-VI Semester (20IT605/JO2C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Objectives:

The course aims to enable the students

- to understand the IoT challenges and architectures.
- to understand the technologies and the standards relevant to the Internet of Things.
- to design and develop IoT applications.
- to understand the significance of cloud platform in the context of IOT

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the Internet of Things and different levels of deployment templates.

CO2 Describe the hardware components, software components and communication protocols of IOT

CO3 Differentiate machine to machine communication and IoT

CO4 Illustrate the available cloud services and communication APIs for developing IOT Applications

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	3	2	2	-	2	-	-	-	3	3	2	2
CO 2	3	2	2	3	2	2	-	2	-	-	-	3	3	2	2
CO 3	3	2	2	3	2	2	-	2	-	-	-	3	3	2	2
CO 4	3	2	2	3	2	2	-	2	-	-	-	3	3	2	2

UNIT - I (11 Hours)

Introduction to IoT: The flavour of the IoT, the technology of the IoT,characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels & deployment templates

UNIT - II (12 Hours)

Elements of IoT : Hardware Components-Computing (Arduino, Raspberry Pi), Sensors, Actuators, I/O interfaces, CommunicationProtocols (ZigBee, Bluetooth, 6LOWPAN, and MQTT),Software

Components-Programming API‟s(using Python/Arduino).

UNIT - III **(12 Hours)**

M2M and IoT Design Methodology : M2M, Differences and Similarities between M2M and IoT, IoT Design Methodology. Software Design Networks(SDN),Network Function Virtualization(NFV).

UNIT - IV **(11 Hours)**

Cloud for IoT and Case Studies: WAMP server, IoT with Cloud – Challenges, AWS ,Xively, Django web application framework,Mapreduce problem. Case Studies: Smart Lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Smart Irrigation.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti. *Internet of Things: A Hands-on-Approach*. VPT, 1 edition, 2014a. ISBN 9788173719547
2. Raj Kamal. *Internet of Things: Architecture and Design*. McGraw Hill Education, 1 edition, 2017a. ISBN 9789352605224

REFERENCES:

1. Hakim Cassimally Adrian McEwen. *Designing the Internet of Things*. John Wiley and Sons, 1 edition, 2014. ISBN 9781118430620
2. Jeeva Jose. *Internet of Things*. Khanna Publishing, 1 edition, 2018. ISBN 9789386173591
3. Omar Elloumi Olivier Hersent, David Boswarthick. *The Internet of Things*. Wiley, 1 edition, 2015. ISBN 9781119994350

Full Stack Development

B.Tech-VI Semester (20ITL601/SOC4)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3.5

Prerequisites:

Course Objectives:

The course aims to enable the students

- to learn React.js front end framework basics
- to learn React.js Application Testing, Deployment and Node.js basics
- to create web server using Express
- to work with Mongo DB

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop React applications using React basic library, forms and routing

CO2 Develop Node.js applications using library node.js

CO3 Develop Client Server applications using Express.js framework

CO4 Construct Node.js applications using Mongo DB databases.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 3	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 4	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3

UNIT - I (18 Hours)

React.js: MERN, MERN Components, Serverless Hello World Application, ES6, DOM, Virtual DOM, Installation. Components in React, using JSX, React Project Structure, create-react-app, Props, State, component life cycle, Handling Events, Component Communication, Data Binding – One way,

two way, SPA.

Working with Forms & Third Party libraries, Routing.

List of Experiments

1. Develop a Calculator React Application
2. Develop a News feed application
3. Develop React application using Forms
4. Develop a website to demonstrate React Routing.

UNIT - II **(18 Hours)**

React.js & Node.JS: Redux Application Architecture, Integrating Redux with React, Testing & Deployment of React Applications.

Node.js, Using Events, Listeners, Timers, and Callbacks in Node.js, Handling Data I/O in Node.js. Accessing the File System from Node.js, Implementing HTTP Services in Node.js.

List of Experiments

1. Develop a Redux application
2. Testing & Deploying React application to GitHub.
3. Develop a Node.js application demonstrating handling data I/O (Buffer, Stream, Zlib modules)
4. Demonstrate accessing Filesystem from Node.js application
5. Implement a HTTP Client and HTTP Server.

UNIT - III **(18 Hours)**

Express.js: Routes, Request and Response objects, Template engine. Understanding middleware, Query middleware, Serving static files, Handling POST body data, Cookies, Sessions, Authentication.

List of Experiments

1. Demonstrate Express Routing.
2. Demonstrate Express.js Cookies
3. Demonstrate Express.js Sessions
4. Demonstrate Express.js Authentication

UNIT - IV **(18 Hours)**

MongoDB: Understanding NoSQL and MongoDB, using mongoDB Compass, using MongoDB Shell, Accessing MongoDB from Node.js.

List of Experiments

1. Demonstrate working with MongoDB using MongoDB Compass.
2. Demonstrate working with MongoDB using MongoDB Shell.
3. Demonstrate accessing MongoDB from Node.js

TEXT BOOKS:

1. Anthony Accomazzo, Ari Lerner, Clay Allsopp, David Guttman, Tyler McGinnis, and Nate Murray. *Fullstack React - The Complete Guide to ReactJS and Friends*. Fullstack.io, 1 edition, 2017. ISBN 9780991344628
2. Brad Dayley, Brendan Dayley, and Caleb Dayley. *Node.js, MongoDB and Angular Web Development*. Addison-Wesley, 2 edition, 2018. ISBN 9780134655536

REFERENCES:

1. Mark Tielens Thomas. *React in Action*. Manning, 1 edition, 2018. ISBN 9781617293856
2. Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich. *Node.js in Action*. Manning, 2 edition, 2017. ISBN 9789386052049
3. Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, and Tim Hawkins. *MongoDB in Action*. Manning, 2 edition, 2016. ISBN 9789351199359
4. Vasan Subramanian. *Pro MERN Stack*. Apress, 2 edition, 2019. ISBN 9781484243909

Machine Learning Lab

B.Tech – VI Semester (20ITL602/CC21)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to implement a linear regression model.
- to implement a Supervised Learning Model.
- to apply ensemble methods for improving the performance of a Classifier.
- to apply K-Means and Hierarchical clustering algorithms.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Fit a linear regression model for the given data.

CO2 Train, Validate and Test a supervised learning model.

CO3 Apply ensemble methods for improving the performance of a Classifier.

CO4 Apply K-Means and Hierarchical clustering methods for clustering the given data.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3

List of Experiments

1. Write a program to implement the linear regression using stochastic gradient descent approach of training for a sample training data set stored as a .CSV file.

2. Write a program to implement the linear regression using Batch gradient descent approach of training for a sample training data set stored as a .CSV file.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the performance of the classifier, considering few test data sets.
4. Write a program to implement the Logistic regression for a sample training data set stored as a .CSV file. Compute the performance of the classifier, considering few test data sets.
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Compute the performance of the classifier, considering few test data sets.
6. Write a program to demonstrate the working of the Support Vector Machine Classifier. Use an appropriate data set for building the Classifier and apply this knowledge to classify a new sample. Compute the performance of the classifier, considering few test data sets.
7. Write a program to implement the Random Forest classifier for a sample training data set stored as a .CSV file. Compare the performance of the classifier with any weak classifier, considering few test data sets.
8. Write a program to implement the AdaBoost classifier for a sample training data set stored as a .CSV file. Compare the performance of the classifier with Random Forest classifier, considering few test data sets.
9. Apply k-Means algorithm to cluster a set of data stored in a .CSV file. Calculate the quality of clustering solution.
10. Apply Hierarchical clustering algorithm to cluster a set of data stored in a .CSV file using different linkages. Use the same data set for clustering using k-Means algorithm. Compare the performances of these two algorithms and comment on the quality of clustering.

TEXT BOOKS:

1. Aurelien Geron. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly publishers, 2 edition, 2019a. ISBN 9781492032649
2. Peter Harrington. *Machine Learning in Action*. Manning, 1 edition, 2012. ISBN 9781617290183

REFERENCES:

1. Andrew Ng. *Machine Learning Lecture Notes*. Stanford University. URL `https://see.stanford.edu/Course/CS229`
2. Sebastian Raschka and Vahid Mirjalili. *Python Machine Learning*. Packt Publishing, 2 edition, 2017. ISBN 9789352136278
3. Andreas C. Müller and Sarah Guido. *Introduction to Machine Learning with Python*. Oreilly, 1 edition, 2016. ISBN 9781449369415
4. Tom M. Mitchell. *Machine Learning*. Mc.Graw Hill, 1 edition, 1997. ISBN 0070428077. URL `http://www.cs.cmu.edu/~tom/mlbook.html`

Enterprise Programming Lab
B.Tech (20ITL603/JOL2A)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

Programming for Problem Solving (20ITL203/CSL01)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop Java EE applications using JDBC and Java Servlets following the HTTP protocol.

CO2 Develop dynamic, interactive web applications using JSP and JSF.

CO3 Develop Web Service and Web Socket applications

CO4 Develop enterprise applications using EJB

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3

List of Experiments

1. Write a JDBC application to implement DDL and DML commands.
2. Write an application to demonstrate HTTP Servlets.
3. Write an application to demonstrate cookie & Sessions.
4. Write an application to integrate JSP & Servlets.
5. Write an application to demonstrate custom tags and standard tags in JSP.
6. Write an application to demonstrate JSF validators, event handlers and convertors.
7. Write an application to demonstrate web service.
8. Write a chat application using Web sockets.
9. Write an application to demonstrate Session Bean and Entity Bean (persistence).
10. Write an application to demonstrate Asynchronous and Timer services of Enterprise Bean.

TEXT BOOKS:

1. Dr. Danny Coward. *Java EE 7: The Big Picture*. Oracle press, 7 edition, 2014. ISBN 9780071837330
2. Arun Gupta. *Java EE 7 Essentials*. O'Reilly, 7 edition, 2013. ISBN 9781449370176

REFERENCES:

1. Antonio Goncalves. *Beginning Java EE 7*. Apress, 7 edition, 2013. ISBN 9781430246268

Middleware Technologies Lab
B.Tech (20ITL603/JOL2B)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Prerequisites:

Programming for Problem Solving (20ITL203/CSL01)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop C# applications using Arrays, Strings, Lists and parameters,

CO2 Develop C# applications using inheritance, polymorphism, exception handling and events.

CO3 Develop an ASP.NET applications using html controls, web controls, list controls and validation controls.

CO4 Develop an ASP.NET application using state management, ADO.NET and Data controls.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	-	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	3	3	-	3	3	3	3

List of Experiments

1. Write a program to demonstrate Arrays (2-D and jagged).
2. Design a class to demonstrate String class methods.
3. Implement a class List and the list operations. Use all possible basic features of C#.
4. Write a C# program to demonstrate Ref, Out & Variable No. of Arguments.
5. Implement a class hierarchy with Abstract Classes, Virtual methods & Overriding.
6. Write a C# program to demonstrate interfaces.
7. Write a C# program to create and handle user defined exception.
8. Implement a class COck that publishes seconds change event. Design classes that subscribe to the event with respective behaviors.

9. Design an ASP.NET application to demonstrate HTML controls.
10. Design an ASP.NET application to demonstrate Web Controls.
11. Design an ASP.Net application to demonstrate different List Controls.
12. Design an ASP.NET application to demonstrate Validating user input using Validation Controls.
13. Design an ASP.Net application to demonstrate the use of Vie State and Session State.
14. Design an ASP.NET application to work with SQL Server Database using ADO.NET.
15. Design an ASP.NET application to work with SQL Server Database using Data Controls.

TEXT BOOKS:

1. Herbert Schildt. *C# 4.0 The Complete Reference*. Tata McGraw Hill, 1 edition, 2010. ISBN 9780321564085

REFERENCES:

1. Ian Griffiths. *Programming C# 5.0*. O'REILLY, 1 edition, 2012. ISBN 9780321564085

Industrial Internet of Things Lab
III B.Tech – VI Semester (20ITL603/JOL2C)

Lectures	:	0 Periods / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Implement interfacing of various sensors with Arduino/Raspberry Pai.

CO2 Demonstrate the ability to transmit data in wireless mode between different devices.

CO3 Implement an IOT application to upload/download sensor data on cloud and server.

CO4 Implement an IOT application for smart city using Arduino Uno/ Raspberry Pai.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3
CO2	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3
CO3	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3
CO4	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3

LIST OF EXPERIMENTS

1. Arduino Uno Development Kit:Familiarization with Arduino Uno hardware, software, and perform necessary software installation.
2. Outputting Digital Signal: a) Interface LED/Buzzer with Arduino Uno and write a program to turn ON LED for 1 sec after every 2 seconds. b)Interface Buzzer with Arduino Uno and write a program to turn ON sound by Buzzer for 2 seconds.
3. Inputting Digital Signal: a)Interface push button and LED with Arduino Uno and write a program to turn ON LED when push button is pressed. b)Interface digital sensor (IR-infrared sensor) with Arduino Uno and write a program to turn ON Sound by Buzzer when object detects.
4. Inputting Analog Signal: a)Interface Potentiometer with Arduino Uno and write a program to increase and decrease light intensity of LED. b)Interface LDR light sensor with Arduino and write a program to control LED.
5. Reading and Writing Data: Interface 4 x 4 key pad and LCD display with Arduino Uno and write a program to display pressed value on LCD.
6. NodeMCU: a)Familiarization with NodeMCU hardware, software, and perform necessary software installation. b)Interface RGB LED with NodeMCU and write a program to turn ON/OFF different colors for 2/3 seconds.

7. Web Server: Interface motor using relay with NodeMCU and write a program to turn ON/OFF motor with help of relay when button is pressed from server web page.
8. Raspberry Pi: Familiarization with single board computer (SBC), Raspberry Pi hardware, software, and perform necessary software installation.
9. Radio Frequency Identification (RFID): Interface RFID with Raspberry Pi and write a program to print tag information (accept/reject) on OLED display.
10. Short Range Communication: Interface Bluetooth and heart beat rate sensor with Raspberry Pi and write a python program to send beats per minute (BPM) rate to smart phone using Bluetooth.
11. COud Communication: a)Interface DHT11 sensor and write a python program on Raspberry Pi to upload temperature and humidity data to thingspeak COud. b)Interface DHT11 sensor and write a program on Raspberry Pi to retrieve temperature and humidity data from thingspeak COud.
12. Machine-to-Machine (M2M) Protocol: a)Write a program on Raspberry Pi to publish temperature and humidity data to MQTT broker. b)Write a program on Raspberry Pi to subscribe to MQTT broker for temperature and humidity data and print it.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti. *Internet of Things: A Hands-on-Approach*. VPT, 1 edition, 2014b. ISBN 9788173719547
2. Raj Kamal. *Internet of Things: Architecture and Design*. McGraw Hill Education, 1 edition, 2017b. ISBN 9789352605224

Indian Constitution

(Common to all branches)

B.Tech – VI Semester (20IT606/MC03)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	00	Credits	:	0

Prerequisites:

None

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Discuss the historical and features, characteristics of the Indian Constitution on the scheme of fundamental rights.

CO2 Describe fundamental duties and DPSP, the parliamentary forming, powers and status of the President of India.

CO3 Explain amendment procedures, emergency provisions, and local self-government in India.

CO4 Discuss ECI, AG, PSC and amendments

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-

UNIT - I (7 Hours)

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the constitution of India, Scheme of fundamental rights.

UNIT - II (8 Hours)

The scheme of the fundamental duties and its legal status, The Directive principles of state policy- its importance and implementation, Federal structure and distribution of legislative and financial powers between the union and the states, Parliamentary form of government of India – the constitution powers and status of the president of India.

UNIT - III (8 Hours)

Amendment of constitutional powers and procedure, The historical perspectives of the constitutional amendments in India, Emergency provisions: National Emergency, President Rule, Financial

Emergency, Local Self Government – constitutional scheme in India

UNIT - IV **(7 Hours)**

Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.

TEXT BOOKS:

1. D.D.Basu and Lexisnexis. *Introduction to constitution of India*. Universal, 26 edition, 2020. ISBN 9780321564085
2. P. M. Bhakshi. *The constitution of India*. Universal law publishing, 1 edition, 2020. ISBN 9780321564085

Wireless Networks
B.Tech (20IT701/PE3A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Computer Networks (20IT502)

Course Objectives:

The course aims to enable the students

- to describe the merits and demerits and medium access control mechanisms of wireless communication.
- to describe the architecture of cellular networks upto 3G and satellite communications.
- to describe wireless LAN standards.
- to explain 4G and 5G cellular networks.

Course Outcomes:

After the successful completion of the course the students will be able to

CO1 Describe the merits and demerits and medium access control mechanisms of wireless communication.

CO2 Describe the architecture of cellular networks upto 3G and satellite communications.

CO3 Describe wireless LAN standards.

CO4 Explain 4G and 5G cellular networks.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	-	-	-	2	-	-	-	-	-	2	3	2	2
CO 2	3	2	-	-	-	2	-	-	-	-	-	2	3	2	2
CO 3	3	2	-	-	-	2	-	-	-	-	-	2	3	2	2
CO 4	3	2	-	-	2	2	-	-	-	-	-	2	3	2	2

UNIT - I **(12 Hours)**

Introduction: Applications, Short History of Wireless Communications, Simplified Reference Model.
Wireless Transmission: Frequencies, Signals, Signal Propagation, Multiplexing, Modulation, Spread Spectrum, and Cellular Systems.
Medium Access Control: Motivation for a Specialized MAC, SDMA, FDMA, TDMA, CDMA, and Comparison.

UNIT - II **(12 Hours)**

Telecommunication Systems: GSM, DECT, TETRA, UMTS and IMT-2000: System Architecture and Radio Interface.
Satellite Systems: History, Applications, Basics, Routing, Localization, and Handover.

UNIT - III **(12 Hours)**

Wireless LAN: Infrared Vs. Radio Transmission, Infrastructure and Ad-hoc Networks, IEEE 802.11: System Architecture, Protocol Architecture, Physical Layer, MAC Layer, and MAC Management.
Mobile Network Layer: Mobile IP: Entities and Terminology, IP packet delivery, Agent discovery, Registration, and Tunneling and Encapsulation, Dynamic Host Configuration Protocol. Ad Hoc Networks.

UNIT - IV **(12 Hours)**

4G Cellular Networks: Driving factors, Evolved Radio Access Network, Evolved Packet Core Network.
5G Cellular Networks: Driving factors, Next Generation Radio Access Network, 5G Core Network.

TEXT BOOKS:

1. Jochen. Schiller. *Mobile communications*. Addison-Wesley, 2 edition, 2003. ISBN 9780321123817
2. William Stallings. *5G Wireless A Comprehensive Introduction*. Addison-Wesley, 2021. ISBN 9780136767145

REFERENCES:

1. Martin Sauter. *From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband*. John Wiley & Sons, 3 edition, 2017. ISBN 9781119346906
2. UWE Hansmann, Lother Merk, Martin S. Nicklous, and Thomas Stober. *Principles of Mobile Computing*. Addison-Wesley, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Dr.Ranjan Bose. *Wireless Communications*. IIT Delhi, 2008. URL `https://youtu.be/CUyF0YGIA5Y?list=PL1A4AFAC7AC1909C9`

Big Data Analytics

B.Tech-VII Semester (20IT701/PE3B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Objectives:

The course aims to enable the students

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe fundamental concepts of Big Data Analytics, including its characteristics, applications, and the Hadoop ecosystem

CO2 Describe the architecture and working principles of YARN and MapReduce in the Hadoop environment

CO3 Write scripts using Pig and Hive to process and query large datasets on Hadoop clusters

CO4 Write scripts using Spark and Sqoop for fast, scalable data processing and data import/export in Hadoop-based systems

Mapping of Course Outcomes with Program Outcomes:

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	-	-	2	-	-	-	2	2	2	2
CO2	3	3	3	3	3	-	-	2	-	-	-	2	2	2	3
CO3	3	3	3	3	3	-	-	2	-	-	-	2	3	3	3
CO4	3	3	3	3	3	-	-	2	-	-	-	2	3	3	3

UNIT - I (11 Hours)

Big Data Analytics: Introduction to Big Data Analytics, Characteristics of Big Data, Sources of Big Data, Applications of Big Data.

HADOOP: Introduction to Hadoop, Hadoop components, Configuration of Hadoop.

The Hadoop Distributed File System: The design of HDFS,HDFS concepts, The command line interpreter , Basic File system operations, Hadoop File System, Interfaces Data flow, parallel copying with distcp.

UNIT - II **(11 Hours)**

YARN: Anatomy of YARN application run, YARN compared to Map Reduce 1, Scheduling in YARN.
How Map Reduce Works?: Anatomy of Map Reduce job run, Failures, Shuffle and sort, Task execution. Map Reduce Features-Counters, sorting, joins side data distribution, Writing map reduce programs, deploying map reduce programs on Hadoop Cluster.

UNIT - III **(12 Hours)**

Pig: Installing and Running Pig-Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example, Comparison with Databases, Pig Latin-Structure, Statements, Expressions, Types, Schemas, Functions, Macros, User-Defined Functions-A Filter UDF, An Eval UDF, Data Processing Operators-Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data, Pig in Practice-Parallelism, Anonymous Relations, Parameter Substitution.
Hive: The Hive Shell, An example, Running Hive, Configuring Hive, Hive Services, The Metastore, Comparison with traditional databases, Schema on Read versus Schema on Write, Update, transactions and Indexes, SQL on Hadoop alternatives, HiveQL, Data types, Operators and functions, Tables, Querying Data-sorting and aggregating, MapReduce Script, joins, Sub queries, Views.

UNIT - IV **(12 Hours)**

Spark: Installing spark, an example spark application, jobs, stages, tasks, a scalastand alone application, anatomy of spark job run, job submission, DAG construction, task scheduling, task execution, execution cluster managers, spark on YARN.
Sqoop: Getting Sqoop, Sqoop Connectors, A Sample Import, Text and Binary File Formats, Generated Code, Additional Serialization Systems, Imports: A Deeper Look, Controlling the Import, Imports and Consistency.

TEXT BOOKS:

1. Tom White. *HADOOP "The Definitive Guide":Black Book on Big Data*. O'Reilly Publications, 4 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Jeffrey Aven. *Hadoop in Action,Hadoop Beginner's Guide, Optimizing Hadoop for Map Reduce, Scaling Big Data with Hadoop and Solr*. O'Reilly Media, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Dr. Rajiv Misra. *NPTEL Course on Distributed Systems*. IIT Patna, 2017. URL `https://youtu.be/AWryELkUwow?list=PLn0UTNtgXJLZD_fY4zZ78X-YHM1V5-m8m`

Natural Language Processing
B.Tech (20IT701/PE3C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

NIL

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the tasks relevant to NLP and represent text in numerical format

CO2 Describe the process of text classification

CO3 Describe the process of modelling a natural language

CO4 Describe the process of language translation

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3
CO 4	3	3	3	-	3	-	-	-	-	-	-	3	3	3	3

UNIT - I (11 Hours)

Introduction: - Understanding natural language processing, Understanding basic applications, Advantages of togetherness-NLP and Python, Environment setup for NLTK.
Practical Understanding of a Corpus and Database: - What is a corpus? Why do we need a corpus? Understanding corpus analysis, Understanding types of data attributes, Exploring different file formats for corpora, Resources for accessing free corpora, Preparing a dataset for NLP applications, Web scraping.

UNIT - II (12 Hours)

Understanding the Structure of a Sentence: - Understanding components of NLP, Natural language understanding, Defining context-free grammar, Morphological analysis, Syntactic analysis, Discourse integration, Pragmatic analysis.

UNIT - III **(12 Hours)**

Preprocessing: - Handling corpus-raw, Handling corpus-raw sentences, Basic preprocessing, Practical and customized preprocessing.

UNIT - IV **(11 Hours)**

Feature Engineering and NLP Algorithms:- Understanding feature engineering, Basic feature of NLP, Basic statistical feature of NLP, Advantages of features engineering, Challenges of features engineering.

TEXT BOOKS:

1. Jalaj Thanaki. *Python Natural Language Processing*. Packt Publishers, 1 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Tanvir Siddiqui. *Natural Language Processing*. Oxford Publishers, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Pushpak Bhattacharyya. *Natural Language Processing*. IIT Bomby, 2012. URL `https://youtu.be/aeOLjFe256E?list=PLD392E2ACAEF0C689`

Block Chain Technologies

B.Tech-VII Semester (20IT702/PE4A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

NIL

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe block chain's decentralized system structure and its ecosystem.

CO2 Describe the cryptographic foundations essential to block chain.

CO3 Describe the implications of smart contracts and privacy limitations in block chain.

CO4 Compare alternative block chain technologies and their applications in various industries.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 2	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 3	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2
CO 4	3	2	2	2	-	-	-	-	-	-	-	2	3	2	2

UNIT - I (11 Hours)

Introduction, Structure of a Block, The Genesis Block, Linking Blocks in the Blockchain, Tiers of blockchain technology, Types of blockchain, Features of a blockchain Applications of blockchain technology.

UNIT - II (12 Hours)

Bitcoin Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, Bitcoin network, Mining, Wallets Bitcoin payments, Bitcoin improvement proposals (BIPs) Alternative Coins, Namecoin, Litecoin, Primecoin, Zcash, Trading Zcash, Mining guide, Bitcoin installation, Bitcoin programming and the command-line interface, Bitcoin limitations, Privacy and anonymity.

UNIT - III (12 Hours)

Hyperledger, a Linux Foundation Project, Ten Steps to Your First Blockchain application Ethereum Intr Contract creation transaction, Message call transaction Elements of the Ethereum blockchain, Ethereum virtual machine (EVM) Execution environment, Applications developed on Ethereum, Ethereum

blockchain, The consensus mechanism, The world state Transactions.

UNIT - IV **(11 Hours)**

Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Insurance, Media.

Scalability and Other Challenges: Scalability, Proof of Stake, Privacy, Security, Benefits and limitations of blockchain.

TEXT BOOKS:

1. Imran Bashir. *Mastering Blockchain*. Packet Publishing, 1 edition, 2020. ISBN 9780321564085
2. Andreas Antonopoulos. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*. John Wiley Sons, 1 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Melanie Swa. *Blockchain*. O'Reilly, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Sandeep Shukla. *Block Chain Technology and Applications*. IIT Kanpur, 2020. URL `https://youtu.be/GstOwbLyeYE?list=PLrKK422S1aMma8lDA2JJjEUpC2ycuApuC`

Distributed Systems

B.Tech-VII Semester (20IT702/PE4B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

NIL

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe different architectures of distributed systems.

CO2 Describe process management and communication within distributed systems.

CO3 Describe various naming schemes and resolution techniques.

CO4 Describe various consistency models, replication techniques and fault tolerance mechanisms.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 2	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 3	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2

UNIT - I (11 Hours)

Introduction: What is a distributed system? Design goals, Types of distributed systems.
Architectures: Architectural styles, Middleware organization, System architecture, Example architectures.

UNIT - II (11 Hours)

Processes: Threads, Virtualization, Clients, Servers, Code migration. Communication: Types of Communication, Remote procedure call, Message-oriented communication, Multicast communication.

UNIT - III (12 Hours)

Naming: Names, identifiers, and addresses, Flat naming, Structured naming, Attribute-based naming.
Coordination: COck synchronization, Logical COcks, Mutual exclusion, Election algorithms, Location systems.

UNIT - IV (12 Hours)

Consistency and replication: Introduction, Data-centric consistency models, Client-centric consistency models, Replica management, Consistency protocols.

Fault tolerance: Introduction to fault tolerance, Process resilience, Reliable client-server communication, Reliable group communication, Distributed commit, Recovery.

TEXT BOOKS:

1. Andrew S.Tanenbaum and Maarten Van Steen. *Distributed Systems*. Pearson Education/PHI, 3 edition, 2017. ISBN 9780321564085

REFERENCES:

1. Coulouris, Dollimore, and Kindberg. *Distributed Systems-Concepts and Design*. Pearson Education, 3 edition, 2020. ISBN 9780321564085
2. Mukesh Singhal and Niranjan G. Shivarathri. *Advanced Concepts in Operating Systems*. TMH, 1 edition, 2020. ISBN 9780321564085
3. Sinha. *Distributed Operating System – Concepts and Design*. PHI, 1 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1.

Immersive Technologies

B.Tech-VII Semester (20IT702/PE4C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Computer Animation and Game Design (ASO01).

Course Objectives:

The course aims to enable the students

- to understand the importance and applications of Augmented and Virtual Reality Systems
- to know various types of Hardware and Software used in Augmented and Virtual Reality Systems
- to describe the components of a Virtual Reality system
- to describe the components of an Augmented Reality system
- to know different interaction modalities (eye gaze, gesture and voice)

Course Outcomes:

On completion of the course the learner will be able to;

CO1 Describe the components of augmented & virtual reality systems

CO2 Describe the hardware & software used in augmented & virtual reality systems

CO3 Illustrate the subsystems used in virtual reality systems

CO4 Illustrate the subsystems used in augmented reality systems

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 3	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	3

UNIT - I **(11 Hours)**

Introduction: Introduction to Augmented, Virtual and Mixed Reality, difference between AR ,VR and MR, Components of VR and AR. Challenges of AR and VR systems, Applications of AR and VR systems.

UNIT - II **(11 Hours)**

Theories of Perception: Principle of human vision, Modelling human vision, Colour vision. Principle of hearing,

UNIT - III **(12 Hours)**

Output Interaction Modalities: Displays: Different types of displays, Displays used for AR/VR systems.

Tactile systems

Human Haptic System: haptic sensing, sensory motor control, grasp geometry, Haptic Devices: Criteria to classify haptic devices, Vibrotacticle systems, Force feedback systems and Ultrasound systems. Haptic devices for AR or VR

Auditory systems.

UNIT - IV **(12 Hours)**

Input Interaction Modalities: Eye tracking and gaze control, Types of eye trackers, Head tracker, Types of head trackers, Hand/Finger trackers.

Gesture Recognition: Definition of gesture, Different types of gesture, Gesture recognition from multiple body parts, Basic components of a gesture recognition system.

TEXT BOOKS:

1. Steven M. LaValle. *Virtual Reality*. Cambridge University Press, 2020. doi: http://lavalle.pl/vr/
2. Dieter Schmalstieg and Tobias Hollerer. *Augmented Reality: Principles and Practice*. Addison-Wesley, 1 edition, 2016. ISBN 978-0321883575
3. Erin Pangilinan, Steve Lukas, and Vasanth Mohan. *Creating Augmented and Virtual Realities*. O'Reilly, 1 edition, 2019. ISBN 978-9352138104

REFERENCES:

1. Zeynep Tacgin. *Virtual and Augmented Reality, An Educational Hand Book*. Cambridge Scholars Publishing, 2020. ISBN 978-1527548138
2. Jason Jerald. *The VR Book: Human-Centered Design for Virtual Reality*. Morgan and Claypool, 1 edition, 2015. ISBN 978-1970001129

ON-LINE RESOURCES:

1. Dr.Rahul Swaminathan. *Virtual and Augumented Reality*. IIT Madras, 2019. URL `https://youtu.be/Nq3mPFgpREE`

Cloud Programming

B.Tech-VII Semester (20IT703/JO3A)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Explain cloud service model, deployment models and virtualization technologies.

CO2 Describe the process of developing applications in cloud and usage of EC2, SQS and SNS service.

CO3 Describe the use of EBS, ECR, ECS and S3 through Management Console, AWS CLI, AWS SDK (Java) and CloudWatch.

CO4 Write code to access AWS RDS and No SQL Database service.

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	-	-	2	3	-	-	-	-	-	-	3	3	-	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
CO 3	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
CO 4	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2

UNIT - I (11 Hours)

Introduction to COud Computing: Definition, 5-4-3 principles of COud Computing, COud Eco System, features of COud service, benefits and drawbacks, COud architecture, Anatomy of COud, Network Connectivity in COud Computing, Applications on the COud, Managing the COud, Migrating Application to COud.

COud Deployment and Service Models: Deployment Models, Service Models.

Getting Started with AWS, Amazon COudWatch

UNIT - II (12 Hours)

Hands-on Elastic Compute COud: Introduction to EC2, Features of EC2, EC2 Instance Types, Managing EC2 Using Management Console, Managing EC2 Using AWS CLI, Managing EC2 Using AWS SDK (Java), Monitoring Using COudWatch.

Hands-on Simple Queue Service SQS**:** What Is Messaging Queuing Service?, Introduction of AWS SQS, Features of SQS, Using AWS Management Console, Using AWS CLI, Using AWS SDK—Java, Monitor Using COudWatch.

AWS Lambda & SNS: AWS Lambda, Simple Notification Service SNS.

UNIT - III (12 Hours)

Storage and Container Services: Amazon EBS, Amazon ECR, Amazon ECS

Hands-on Simple Storage Service $S3$ Introduction to AWS S3, Features, Using AWS Management Console, Using AWS CLI, Using AWS SDK - Java, Monitoring Using COudWatch.

UNIT - IV **(11 Hours)**

Working with Data:using AWS RDS, using NoSQL Databases

TEXT BOOKS:

1. Microsoft. *Windows Azure Technical Documentation Library-MSDN*. Microsoft, 1 edition, 2020. ISBN 9780321564085
2. Steve Lydford. *Building ASP. NET web pages with Microsoft WebMatrix*. Apress, 1 edition, 2012. ISBN 9780321564085
3. Collier, Michael, and Robin Shahan. *Microsoft Azure Essentials-Fundamentals of Azure*. Microsoft Press, 1 edition, 2015. ISBN 9780321564085

REFERENCES:

1. Moroney and Laurence. *Introducing Microsoft® WebMatrixTM*. O'REILLY, 1 edition, 2011. ISBN 9780321564085
2. Brunetti and Roberto. *Windows Azure step by step*. Microsoft Press, 1 edition, 2011. ISBN 9780321564085
3. Krishnan and Sriram. *Programming Windows Azure: Programming the Microsoft Cloud*. O'REILLY, 1 edition, 2010. ISBN 9780321564085

ON-LINE RESOURCES:

1. Soumya Kanti Ghosh. *Cloud Computing*. IIT Kharagpur, 2017. URL `https://youtu.be/NzZXz3fJf6o?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J`

Cyber Security

B.Tech-VII Semester (20IT703/JO3B)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the phases of hacking.

CO2 Describe various attacks on computer networks

CO3 Describe various attacks and their counter measure on a computer system.

CO4 Describe various attacks and their counter measures on web application

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	2	2	2	3	-	-	-	-	-	2	3	3	2
CO 2	3	3	2	2	2	3	-	-	-	-	-	3	3	3	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	3	3	3	2
CO 4	3	3	2	2	2	3	-	-	-	-	-	3	3	3	2

UNIT - I (11 Hours)

Hacking: Essential Terminology: Information Security, Cyber Security, Threat, Vulnerability, Exploit. Hackers Motives and Objectives, Penetration Testing and Hacker classes.

Hacking Phases: Footprinting Methodology , Network Scanning and Enumeration

UNIT - II (12 Hours)

Security of Computer Networks: Information gathering, Sniffing and eavesdropping, Spoofing, Session hijacking and Man-in-the-Middle attack, DNS and ARP poisoning, Distributed-Denial-of-Service attacks, Firewall and IDS attacks.

UNIT - III (12 Hours)

Security of Computer Systems: Malware attacks, Password attacks, Denial-of-Service attacks, Unauthorized access, Privilege escalation, Backdoor attacks.

UNIT - IV (12 Hours)

Security of Computer Applications: Improper data / Input validation, Authentication and Authorization attacks, Security misconfiguration, Information disclosure, Buffer overflow issues, Broken session management, SQL injection, Improper error handling and exception management.

REFERENCES:

1. Shon Harris and Fernando Maymi. *CISSP All-in-One Exam Guide*. McGraw-Hill Education, 7 edition, 2016. ISBN 978-0-07-184961-6
2. Shon Harris Allen Harper. *Gray Hat Hacking: The Ethical Hackers Handbook*. McGraw-Hill Education, 3 edition, 2011. ISBN 978-0-07-174256-6

ON-LINE RESOURCES:

1. Saji K Mathew. *Cyber Security and Privacy*. IIT Madras, 2023. URL `https://youtu.be/2d5fKqo6zDc?list=PL7cHwGYCgx7kdWUI7q2ofaoMHfyRQe7fE`

Software Testing Methodologies
B.Tech-VII Semester (20IT703/JO3C)

Lectures	:	3 Hours / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Explain the purpose of testing, different testing models, the impact and classification of bugs, and techniques of flow graphs and path testing.

CO2 Explain dataflow testing techniques.

CO3 Explain logic-based testing techniques.

CO4 Describe software quality and software quality assurance.

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	2	3	-	-	-	-	-	2	3	3	2
CO2	2	3	3	-	-	-	-	-	-	-	-	-			
CO3	1	3	2	-	-	-	-	-	-	-	-	-			
CO4	1	2	3	-	-	-	-	-	-	-	-	-			

UNIT - I (11 Hours)

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II (12 Hours)

Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

Paths, Path products and Regular expressions: path products and path expression, reduction procedure, applications, regular expressions and flow anomaly detection.

UNIT - III (11 Hours)

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications. State, State Graphs and Transition testing: state graphs, good and bad state graphs, state testing,Transition testing.

UNIT - IV (12 Hours)

Software Quality: What Is Quality, Software Quality- ISO 9126 Quality Factors, McCall's Quality

Factors.

Software Quality Assurance: Background Issues , Elements of Software Quality Assurance SQA Tasks, Goals, and Metrics, SQA Tasks, Goals, Attributes, and Metrics ,Formal Approaches to SQA, Statistical Software Quality Assurance, A Generic Example, Six Sigma for Software Engineering ,Software Reliability, Measures of Reliability and Availability, Software Safety , The ISO 9000 Quality Standards ,The SQA Plan.

TEXT BOOKS:

1. Boris Beizer. *Software Testing Techniques*. Dreamtech, 2 edition, 2020. ISBN 9780321564085
2. Roger S.Pressman. *Software Engineering- A Practitioner's Approach*. Tata McGraw-Hill International, 7 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Perry. *Effective Methods of Software Testing*. John Wiley, 1 edition, 2020. ISBN 9780321564085
2. Edward Kit. *Software Testing in the Real World*. Pearson, 1 edition, 2020. ISBN 9780321564085
3. RajibMall. *Fundamentals of Software Engineering*. PHI, 2 edition, 2020. ISBN 9780321564085

ON-LINE RESOURCES:

1. Meenakshi Dsouza. *Software Testing*. IIIT Bangalore, 2019. URL `https://youtu.be/OGImfxO2TEU`

For open elective subject details, please refer Annexure-I

Industrial Management & Entrepreneur Development

IV B.Tech – VII Semester (20IT705/ME01)

Lectures	:	3 Periods / Week	Tutorial	:	0	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	3

Prerequisites:

Course Objectives:

The course aims to enable the students

- to gain an insight into the concepts of general, scientific management and various forms of business organizations along with awareness about various organization structures
- to understand the basics of human resource management, marketing management.
- to understand inventory control concepts, fundamentals of TQM, and supply chain management.
- to understand financial management and realize the importance of Entrepreneurship.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the various functions of the management. Learn various forms and structures of business organizations.

CO2 Describe the resources to be planned, various motivation theories, leadership styles and marketing management.

CO3 Explain inventory control, total quality management and supply chain management.

CO4 Describe the importance of entrepreneurship and various types of capital.

CO	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO 2	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO 4	2	3	2	3	-	-	-	-	-	-	3	3	2	-	-

UNIT - I (11 Hours)

General Management: Management definition, Functions of Management and Principles of Management.

Scientific Management Definition, Principles of Scientific Management

Forms of Business Organization Choice of form of organization, Salient features of Sole Proprietorship,

Partnership, Joint Stock Company: Private Limited and Public Limited companies; Merits and demerits.
Organization: Definition, Line, line and staff, functional and matrix organizationIntroduction to Strategic Management: Definition and scope

UNIT - II **(12 Hours)**

Human Resource Management: Functions of HR management, human resource planning, recruitment, selection, placement, training & development and performance appraisal, Motivation theories, leadership styles.
Marketing Management: Concepts of Selling and Marketing, Functions of Marketing, Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle; distribution channels

UNIT - III **(12 Hours)**

Materials Management Inventory Control, objectives of inventory control, Inventory costs, Basic EOQ model, Model with Price breaks, ABC analysis, FSN Analysis, VED Analysis.
Total Quality Management: Definition of, Importance of quality, Phases of quality management, quality control, Difference between Inspection and Quality control, Components of total quality, Quality Function Deployment
Introduction to Supply Chain Management: Definition, scope of SCM, Drivers of SCM, Advantages, limitations

UNIT - IV **(11 Hours)**

Financial Management: Functions of finance, Types of Capital-Fixed and Working Capital, Break Even Analysis.
Entrepreneurship Development: Introduction, Entrepreneurial characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship; Role of communication in entrepreneurship; Entrepreneurial development-Objectives, Need of Training for enterprises; Finance for the enterprises.

TEXT BOOKS:

1. Essentials of Management. *Koontz and Heinz Weihrich*. Tata-McGraw-Hill, 10 edition, 2012. ISBN 978-1259005121
2. Amrine. *Manufacturing Organization and Management*. Pearson Education, 6 edition, 2004. ISBN 978-8177582758
3. A. R. Aryasri. *Management Science*. McGraw Hill Education India, 4 edition, 2008. ISBN 9780070090279
4. M Mahajan. *Industrial Engineering and production management*. Dhanapatrai Publications, 1 edition, 2015. ISBN B01N6RVM7L
5. Philip Kotler. *Marketing Management*. Pearson Education, 15 edition, 2015. ISBN 978-9332557185

DevOps

B.Tech-VII Semester (20ITL701/SOC5)

Lectures	:	2 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3.5

Prerequisites:

Course Objectives:

The course aims to enable the students

- to understand the concepts of DevOps.
- to use GitHub and Jenkins tools.
- to use continuous Integration and Testing tools.
- to use Configuration Management and Continuous Monitoring Tools.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Deploy application to Github and write git shell commands.

CO2 Demonstrate continuous integration using Jenkins.

CO3 Demonstrate containerization using Docker, Kubernetes.

CO4 Demonstrate the use of Puppet, Ansible and Nagios.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 3	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 4	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3

UNIT - I (18 Hours)

DevOps Basics & Version Control: Definition of DevOps, DevOps Stakeholders, DevOps goals, DevOps life cycle.
Version Control, Continuous Integration, Continuous Delivery, Continuous Deployment, Continuous Monitoring.

Git basics, Git features, installing Git, Git essentials, common commands in Git, Working with remote repositories.

List of Experiments

1. Demonstrate Deploying an Application to GitHub.
2. Demonstrate working with Git Shell commands.
3. Demonstrate working with remote repositories.

UNIT - III **(18 Hours)**

Continuous Integration using Jenkins: Introduction-Understanding Continuous Integration, introduction about Jenkins, Build Cycle, Jenkins Architecture, installation, Jenkin management. Adding a slave node to Jenkins, Building Delivery Pipeline, Pipeline as a Code.

List of Experiments

1. Demonstrate Building Delivery Pipeline using Jenkins.
2. Demonstrate using Selenium tool.

UNIT - III **(18 Hours)**

Continuous Deployment: Containerization with Docker, Containerization using Kubernetes.

List of Experiments

1. Demonstrate Containerization with Docker.
2. Demonstrate Containerization with Kubernetes.

UNIT - IV **(18 Hours)**

Configuration Management and Continuous Monitoring: Configuration Management with Puppet, Ansible, Continuous Monitoring with Nagios.

List of Experiments

1. Demonstrate Configuration Management using Puppet.
2. Demonstrate Configuration Management with Ansible.
3. Demonstrate Continuous Monitoring with Nagios.

TEXT BOOKS:

1. Patrick Debois Gene Kim, Jez Humble and John willis. *The DevOps Handbook*. IT Revolution Press,LLC, 1 edition, 2016. ISBN 978-1942788003

REFERENCES:

1. Jennifer Davis & Ryn Daniels. *Effective DevOps*. Oreilly publications, 1 edition, 2018. ISBN 978-1-492-07309-3
2. George Spafford Gene Kim, Kevin Bher. *CThe Phonex Project*. IT Revolution, 1 edition, 2018. ISBN 978-194278294

Cloud Programming Lab
B.Tech (20ITL702/JOL3A)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Develop applications using Java and deploy on Linux VM

CO2 Develop applications in cloud using EC2, SQS and SNS EC2 service.

CO3 Develop cloud applications using S3, EBS, ECR and ECS, RDS and NoSQL Database service

CO4 Develop cloud applications using RDS, and NoSQL services, RDS and NoSQL Database service

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 2	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 3	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3
CO 4	3	3	3	3	3	3	-	-	3	2	-	3	3	3	3

List of Experiments

1. Develop a COud application using Java and deploy it to AWS COud.
2. Demonstrate deploying and using Linux VM in the AWS COud.
3. Develop a COud application to demonstrate AWS Compute Services.
4. Develop a COud application to use Simple Queue Service(SQS).
5. Develop a COud application using with Amazon SNS.
6. Develop a COud application using with Amazon Simple Storage Service(S3).
7. Develop a COud application to use Amazon EBS.
8. Develop a COud application using AWS ECR & AWS ECS.
9. Develop a COud application using AWS S3.
10. Develop a COud application using Amazon Relational Database Service(RDS).
11. Develop a COud application to work with NoSQL database.

TEXT BOOKS:

1. Microsoft. *Windows Azure Technical Documentation Library-MSDN*. Microsoft, 1 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Moroney and Laurence. *Introducing Microsoft® WebMatrixTM*. O'REILLY, 1 edition, 2011. ISBN 9780321564085

Cyber Security Lab
B.Tech (20ITL702/JOL3B)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Apply Recon-ng, Nmap, Dmitry, Net Discover and Snort tools for networks

CO2 Choose a password cracking tool for a web application

CO3 Demonstrate MITM, SQL, DoS, XSS attacks for computers

CO4 Apply Log watch tool for log management

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	3	3	2	3	3	3	-	-	3	2	-	3	3	3	3
CO 2	3	3	2	3	3	3	-	-	3	2	-	3	3	3	3
CO 3	3	3	2	3	3	3	-	-	3	2	-	3	3	3	3
CO 4	3	3	2	3	3	3	-	-	3	2	-	3	3	3	3

List of Experiments

1. Installations:- VM-ware, kali, windows OS, metaspotiable-2, DVWA
2. Information Gathering Tools:- a) Recon-ng b) Nmap c) Dmitry d) Netdiscover
3. Session hijacking, ManinTheMiddle(MTM)Attack
4. Linux Firewall rules configuration by Iptables
5. Snort installation and usage in a) packet sniffing b) packet logging c) IDS Mode d) IPS Mode
6. Hacking any windows OS by using Malware
7. Password Attacks:- a) Online Password cracking with hydra, xhydra. b) Offline Password Cracking with John the ripper
8. Wireless Network attacks:- a) Aircrack-NG. b) Fern Wi-Fi cracker
9. Burpsuit, OWASP ZAP tools
10. DOSattack, Sql-injection, XSS attack
11. Phishing attacks with Setoolkit

REFERENCES:

1. Shon Harris and Fernando Maymi. *CISSP All-in-One Exam Guide*. McGraw-Hill Education, 7 edition, 2016. ISBN 978-0-07-184961-6
2. Shon Harris Allen Harper. *Gray Hat Hacking: The Ethical Hackers Handbook*. McGraw-Hill Education, 3 edition, 2011. ISBN 978-0-07-174256-6

Software Testing Methodologies Lab
B.Tech (20ITL702/JOL3C)

Lectures	:	0 Hours / Week	Tutorial	:	0	Practical	:	3
CIE Marks	:	30	SEE Marks	:	70	Credits	:	1.5

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Identify bugs in a given application.

CO2 Write test cases for a given application.

CO3 Apply tools like Win runner, Selenium, Bugzilla and Bugbit.

CO4 Apply tools like Test Director and Test Link.

List of Experiments

1. Write programs in C Language to demonstrate the working of the following constructs: i) do...while ii) while….do iii) if…else iv) switch v) for
2. A program written in C language for Matrix Multiplication fails. Introspect the causes for its failure and write down the possible reasons for its failure
3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs
4. Write the test cases for any known application (e.g. Banking application)
5. Create a test plan document for any application (e.g. Library Management System)
6. Study of any testing tool (e.g. Win runner)
7. Study of any web testing tool (e.g. Selenium)
8. Study of any bug tracking tool (e.g. Bugzilla, bugbit)
9. Study of any test management tool (e.g. Test Director)
10. Study of any open source-testing tool (e.g. Test Link)

TEXT BOOKS:

1. Boris Beizer. *Software Testing Techniques*. Dreamtech, 2 edition, 2020. ISBN 9780321564085

REFERENCES:

1. Perry. *Effective Methods of Software Testing*. John Wiley, 1 edition, 2020. ISBN 9780321564085

Project-Work
IV B.Tech – VIII Semester (20IT801/PW01)

Lectures	:	0 Hours / Week	Tutorial	:		Practical	:	20
CIA Marks	:	30	SEE Marks	:	70	Credits	:	12

Course Outcomes:

After the successful completion of the project, the students will be able to

CO1 Identify and analyze complex engineering problems and propose feasible solutions.

CO2 Develop a well-structured design or methodology to address the project objectives.

CO3 Analyze experimental data or results from simulations, making conclusions based on statistical and technical analysis.

CO4 Communicate technical information effectively through written reports, including detailed documentation of the methodology, design process, results, and conclusions.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

COs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3

The Project work shall be carried out by a batch consisting not more than four students for one semester. It should help the students to comprehend and apply different theories and technologies that they have learnt through and are learning. It should lead to a substantial result as a comparative study, a new application of the technologies available or some extension to the works carried out by some researcher and published in referred journals. Each batch must carry out the analysis, design, implementation and testing of the entire project basing on the Software Engineering principles.

Continuous Internal Evaluation(CIE)Procedure:

Semester End Examination(SEE)Procedure:

SEE shall be in the form of a Viva-voce and the demonstration of the thesis work for 70 marks. Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner to be appointed by the Principal. A minimum of 40 marks shall be obtained in SEE exclusively and a minimum

Event	Scheduled for	Marks
I Review	VII week	15
II Review	XV week	15
Average of I and II review marks		15
Project report submission	XV week	15
Total marks for CIE		30

total of 65 marks in SEE and CIE put together are to be secured in order to be declared as passed in the Project and for the award of the grade.

Format of Project Report:

This report shall be presented in a number of chapters, starting with Introduction and ending with Summary and Conclusions. Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub-subsection so as to present the content discretely and with due emphasis.

Chapter No.	Chapter Name	Remarks
1	Introduction	It shall justify and highlight the problem posed, define the topic and explain the aim and scope of the work presented in the thesis. It may also highlight the significant contributions from the investigation.
2	Review of Literature	It shall present a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation.
3	Report on the present investigation	Appropriate chapter title shall be given. Due importance shall be given to experimental setups, procedures adopted, techniques developed, methodologies developed and adopted.
4	Results and Discussions	This shall form the penultimate chapter of the report and shall include a thorough evaluation of the investigation carried out and bring out the contributions from the study. The discussion shall logically lead to inferences and conclusions as well as scope for possible further future work.
5	Summary and Conclusions	This will be the final chapter of the report. A brief report of the work carried out shall form the first part of the Chapter. Conclusions derived from the logical analysis presented in the Results and Discussions Chapter shall be presented and clearly enumerated, each point stated separately. Scope for future work should be stated lucidly in the last part of the chapter
6	Appendix	Detailed information, lengthy derivations, raw experimental observations etc. are to be presented in separate appendices, which shall be numbered in Roman Capitals (e.g. ”Appendix IV”). Since reference can be drawn to published/unpublished literature in the appendices these should precede the ”Literature Cited” section.
7	Literature Cited	This should follow the Appendices, if any, otherwise the Summary and Conclusions chapter. The candidates shall follow the style of citation and style of listing in one of the standard journals in the subject area consistently throughout his / her project report.

Advanced Data Structures
(HA)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Data Structures(20IT302)

Course Objectives:

The course aims to enable the students

- to understand the advanced concepts of efficient binary search trees.
- to learn the advanced Hashing and Binomial Heaps.
- to Understand the concepts of Dictionaries and Dis-Joint sets.
- to learn the various string-matching algorithms: Robin-Karp and Knuth Morris-Pratt algorithms.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Construct the various efficient binary search trees: Red-Black tree, Splay trees.

CO2 Analyse advanced hashing techniques and binary heaps.

CO3 Implement disjoint set operations and analyse the union by rank with path compression.

CO4 Analyse the String-Matching Algorithms: naïve and Robin-Karp algorithms.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO2	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO3	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3

UNIT - I **(15 Hours)**

Efficient Binary Search Trees: Red-Black Trees, Splay Trees, 2-3 Trees – Properties, Rotations, Insertion, Deletion.

UNIT - II **(15 Hours)**

Advanced Hashing: Double Hashing, Rehashing, Extendible Hashing.

Priority Queues: Binomial heaps, Symmetric Min-Max Heaps, Fibonacci Heaps - Structure of Fibonacci heaps, Mergeable-heap operations, decreasing a key and deleting a node, Bounding the maximum degree.

UNIT - III **(15 Hours)**

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

Data Structures for Disjoint Set: Disjoint-set operations, Linked-list representation of disjoint sets, Disjoint-set forests, Analysis of union by rank with path compression.

UNIT - IV **(15 Hours)**

String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

TEXT BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*. The MIT Press, Cambridge, 3 edition, 2009. ISBN 9780262533058
2. Michael T.Goodrich and Roberto Tamassia. *Algorithm Design and Applications*. Wiley, 2014. ISBN 9781118335918

Advanced Computer Architecture
(HB)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Computer Organization (20IT305)

Course Objectives:

The course aims to enable the students

- to describe the principles of computer design.
- to compare the performance of different architectures.
- to describe the techniques to improve application performance for different CPU architectures.
- to describe the process of developing applications for high performance computing systems. algorithms.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the principles of computer design.

CO2 Compare the performance of different architectures.

CO3 Describe the techniques to improve application performance for different CPU architectures.

CO4 Describe the process of developing applications for high performance computing systems.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO2	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO3	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3

UNIT - I **(15 Hours)**

Theory of Parallelism: State of computing, Multiprocessors and Multi computers, Multi vector and SIMD computers. PRAM and VLSI models, Architectural development tracks. Program and Network properties.

UNIT - II **(15 Hours)**

Advanced Hashing: Double Hashing, Rehashing, Extendible Hashing.
Priority Queues: Binomial heaps, Symmetric Min-Max Heaps, Fibonacci Heaps - Structure of Fibonacci heaps, Mergeable-heap operations, decreasing a key and deleting a node, Bounding the maximum degree.

UNIT - III **(15 Hours)**

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Data Structures for Disjoint Set: Disjoint-set operations, Linked-list representation of disjoint sets, Disjoint-set forests, Analysis of union by rank with path compression.

UNIT - IV **(15 Hours)**

String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

TEXT BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*. The MIT Press, Cambridge, 3 edition, 2009. ISBN 9780262533058
2. Michael T.Goodrich and Roberto Tamassia. *Algorithm Design and Applications*. Wiley, 2014. ISBN 9781118335918

Graph Theory
(HC)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Data Structures (20IT302/CC03)

Course Objectives:

The course aims to enable the students

- to solve problems related to isomorphism of graphs, Konigsberg bridge problem and Travelling Salesman Problem.
- to find Minimal Spanning Trees in weighted Graphs by using Kruskal's and Prim's Algorithms.
- to solve problems related to graph coloring, planarity of graphs using Kuratowski's algorithm and finding Chromatic number of a given graph.
- to represent Graph using Incidence matrix and Adjacency matrix.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Determine whether a graph is Eulerian and Hamiltonian.

CO2 Apply Kruskal's and Prim's algorithms in order to determine the minimum spanning tree in a connected weighted graph.

CO3 Solve problems related to graph coloring, planarity of graphs using Kuratowski's algorithm and finding Chromatic number of a given graph.

CO4 Analyse the properties of graphs through matrix representation.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO2	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO3	2	3	2	-	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	3	3

UNIT - I **(15 Hours)**

Introduction: Graph, Finite and infinite graphs, Incidence and degree, isolated vertex, pendent vertex and null graph, Isomorphism, Subgraphs, walks, paths and circuits, Connected graphs, Disconnected graphs and Components, Euler graphs(Konigsberg Bridge Problem), Hamiltonian Paths and circuits and Travelling salesman problem.

UNIT - II **(15 Hours)**

Trees and Fundamental Circuits: Trees, Properties of Trees, Distance and centers in a Tree, Rooted and Binary Trees, Spanning Trees, Fundamental circuits, Spanning Trees in a Weighted graphs(Kruskal's Algorithm and Prim's Algorithm).

UNIT - III **(15 Hours)**

Planar and Dual Graphs: Planar graphs; Kuratowski's two graphs; Different Representations of a Planar graph: Euler's formula, Theorem-5.6 and Corollary; Detection of planarity(Kuratowski's theorem); Geometric Dual; Coloring of a Graph, Chromatic number, The four Color problem.

UNIT - IV **(15 Hours)**

Matrix Representation of Graphs: Incidence Matrix, Submatrices of a Graph, Circuit Matrix, Fundamental Circuit Matrix and Rank of B, Application to a switching network, Cut-set Matrix, Relationship among A_f, B_f and C_f, Path Matrix and Adjacency Matrix.

TEXT BOOKS:

1. Narsingh Deo. *Graph Theory with Applications to Engineering and Computer Science*. PHI. ISBN 9788120301450

REFERENCE BOOKS:

1. Douglas B. West. *Introduction to Graph Theory*. Pearson, 2 edition, 2015. ISBN 9789332549654

Optimization Techniques
(HD)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

None

Course Objectives:

The course aims to enable the students

- to gain knowledge on theory of optimization and conditions for optimality for unconstraint and constraint optimization problems
- to inculcate modeling skills necessary to describe and formulate optimization problems in design and manufacturing
- to familiarize with the working principle of optimization algorithms used to solve linear and non-linear problems
- to solve optimization problems using software tools

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Formulate the engineering problems as an optimization problem.

CO2 Apply necessary and sufficient conditions for a given optimization problem for optimality

CO3 Select appropriate solution methods and strategies for solving an optimization problem and interpret and analyze the solution obtained by optimization algorithms

CO4 Justify and apply the use of modern heuristic algorithms for solving optimization problems

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3

UNIT - I **(15 Hours)**

Introduction: Engineering applications, Statement of an optimization problem, Classifications of Optimization problems, Optimal problem formulation, Optimality criteria, Classical optimization techniques and Kuhn-Tucker (KT) optimality conditions.

UNIT - II **(15 Hours)**

Non-linear programming: One dimensional minimization methods, Unconstrained optimization techniques, Constrained optimization techniques, Transformation methods, Interior and exterior penalty function method, Convergence and divergence of optimization algorithms and Complexity of algorithms.

UNIT - III **(15 Hours)**

Modern Methods in Optimization: Genetic Algorithm, Simulated Annealing, Particle Swarm Optimization, Neural Network based optimization, Optimization of Fuzzy systems, Multi-Objective optimization, Data Analytics and optimization using Machine learning approach.

UNIT - IV **(15 Hours)**

Matrix Representation of Graphs: Implementing optimization algorithms in Matlab / R / Python environment and solving linear, non-linear, multi-objective unconstrained and constrained optimization problems.

TEXT BOOKS:

1. Narsingh Deo. *Graph Theory with Applications to Engineering and Computer Science*. PHI. ISBN 9788120301450

REFERENCE BOOKS:

1. Douglas B. West. *Introduction to Graph Theory*. Pearson, 2 edition, 2015. ISBN 9789332549654

Advanced Database Management Systems
(HE)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Database Management Systems(20IT403)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe NoSQL Databases.

CO2 Manage Document-oriented NoSQL databases.

CO3 Execute CRUD operations on MongoDB database.

CO4 Evaluate NoSQL database development tools and programming languages.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	3	3

UNIT - I (15 Hours)

Introduction to NoSQL: Difference between RDBMS and NoSQL Databases, Definition of NoSQL, History of NOSQL, NoSQL Storage Architecture, Types of NoSQl databases- Document Databases, Key-value databases, Column Oriented databases, Graph databases. When to use NoSQL and when not?, Interfacing and Interacting with NoSQL.

UNIT - II (15 Hours)

Introduction to MongoDB: MongoDb Installation, Basics of MongoDb, MongoDb Shell, MongoDb Datatypes, MongoDb CRUD operations: Adding new documents to a collection, Selecting documents, Updating existing documents, Removing documents from a collection.

UNIT - III (15 Hours)

MongoDb Aggregation Frameworks and MongoDb Aggregation Operations:$group, $limit, $project, $sort, $match, $add fields, $count, $lookup, $out operators. MongoDb sorting, MongoDb

Indexing: Single field Indexes, Sorting with Indexes, Compound Indexes, Partial Indexes.

UNIT - IV **(15 Hours)**

MongoDB Import and Export, Sharding in MongoDB, MongoDb Python Drivers, Python and MongoDB, Creating Application with Python and MongoDB.

TEXT BOOKS:

1. Shannon Bradshaw, Eoin Brozil, and Krishna Chodorow. *MongoDB-The definitive guide*. Oreilly, 3 edition, 2020. ISBN 9789352139576

Software Project Management
(HF)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Software Engineering(20IT503)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Create an end-to-end project plan to address the complex software delivery dealing with the principles and practices of traditional Project Management.

CO2 Design and develop innovative software products by addressing complex user problems dealing with the principles and practices of Product Management.

CO3 Compare and determine whether using traditional project management or agile project management would be more appropriate for a project.

CO4 Develop agile project plans to address the complex software delivery and the problems arising out of the traditional methods by applying Agile manifesto and the practices.

CO5 Apply the world's popularly used scrum framework and practices to take agile project management to its next level for efficient, value-based delivery and increased stakeholder satisfaction.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	-	3	-	-	-	2	-	3	2	2	3	3
CO2	3	3	2	-	3	-	-	-	2	-	3	2	2	3	3
CO3	3	3	2	-	3	-	-	-	2	-	3	2	2	3	3
CO4	3	3	2	-	3	-	-	-	2	-	3	2	2	3	3

UNIT - I (15 Periods)

Software Project Management: Introduction, Principles of Project Management, WBS, Process Groups, Knowledge Areas, Models, Methods and Artifacts, Stakeholder Management, Capstone.
Tools: Microsoft Project, Gannt Charts.

UNIT - II (15 Periods)

Software Product Management: Product Life Cycle, Product Manager, Product Vision and Strategy,

Product Discovery, Product Design, Product Roadmaps, Product Backlog, Prioritization Techniques, Competitive and Market Analysis, MVP, GTM (Go to Market), Product Analytics, Capstone.
Tools: Figma, Google Analytics, Hotjar.

UNIT - III **(15 Periods)**

Agile Project Management: : Fundamentals of Agile Project Management, Agile Manifesto, Roles and Responsibilities, Preparing for Agile Project Management, Pre-project, Foundation process and Products, Evolutionary Development, Techniques and Practices, Agile Planning, Agile Control.

UNIT - IV **(15 Periods)**

Scrum: Scrum Definition and Framework, Scrum Theory, Scrum Values, Scrum Team, Scrum Events, Scrum Artifacts, User Story & Acceptance Criteria, Sizing Stories, Capacity Planning, Velocity of a Team, KPI's, Iterative vs Incremental Development, Release Planning. **Tools**: Jira/Trello, Planning Poker.

TEXT BOOKS:

1. *A Guide to the Project Management Body of Knowledge*. Project Management Institute, 7 edition, 2021. ISBN 9781628256642

REFERENCES:

1. Hans Bernd Kittlaus and Samuel A. Fricker. *Software Product Management*. Springer Nature, 2017. ISBN 9783642551390
2. Andrew Stellman and Jennifer Greene. *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*. O'Reilly, 2014. ISBN 9781449331924

ON-LINE RESOURCES:

1. https://www.wrike.com/product-management-guide/product-management-definition/
2. https://www.atlassian.com/agile/product-management
3. https://www.aha.io/roadmapping/guide/product-managementf
4. https://agilemanifesto.org/
5. https://scrumguides.org/scrum-guide.html

Storage Area Networks
(HG)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Operating Systems (20IT304/CC05) and Database Management Systems (20IT403/CC10)

Course Objectives:

The course aims to enable the students

- to provide an understanding of the evolution and fundamental concepts of storage systems and their role in data centers.
- to explore storage networking technologies, virtualization, and their applications in managing information.
- to familiarize students with business continuity solutions, backup methods, and replication techniques for data security.
- to introduce cloud computing concepts, security frameworks, and lifecycle management of storage infrastructure.
- to enable students to evaluate storage solutions for different environments and analyze performance impact.

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Explain the key components of storage systems, RAID techniques, and intelligent storage implementations.

CO2 Analyze storage networking technologies such as SAN, NAS, and unified storage platforms, and evaluate their benefits.

CO3 Describe data backup, replication, and archiving methods to ensure business continuity in various environments.

CO4 Illustrate the transition to cloud computing, addressing security and management challenges in storage infrastructure.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	2	1	-	-	-	-	-	-	2	3	3	3
CO2	3	2	3	2	1	-	-	-	-	-	-	2	3	3	3
CO3	3	2	3	2	1	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	2	1	-	-	-	-	-	-	2	3	3	3

UNIT - I (15 Hours)

Storage Systems and Architecture: Introduction to the evolution of storage architecture, key data center elements, virtualization, and cloud computing.Key data center elements: Host (or compute), connectivity, storage, and application in both classic and virtual environments. RAID implementations, techniques, and levels, along with the impact of RAID on application performance. Components of intelligent storage systems, virtual storage provisioning, and intelligent storage system implementations.

UNIT - II (15 Hours)

Storage Networking and Virtualization: Fibre Channel SAN components, connectivity options, and topologies, including access protection mechanism ”zoning.”FC protocol stack, addressing, and operations. SAN-based virtualization, VSAN technology, and iSCSI and FCIP (Fibre Channel over IP protocols for storage access over IP network). Converged protocol FCoE and its components.Network Attached Storage (NAS): components, protocol, and operations. File-level storage virtualization, object-based storage, and unified storage platforms.

UNIT - III (15 Hours)

Backup, Archiving, and Business Continuity: Information availability and business continuity solutions in virtualized and non-virtualized environments. Business continuity terminologies, planning, and solutions. Clustering and multipathing architecture to avoid single points of failure.Backup and recovery methods, targets, and topologies.Data deduplication and backup in virtualized environments.Fixed content and data archive, local and remote replication in classic and virtual environments, three-site remote replication, and continuous data protection.

UNIT - IV (15 Hours)

Cloud Computing and Storage Security: Characteristics, benefits, and business drivers of cloud computing.Definition and essential characteristics of cloud computing.Phases of the journey to the cloud and steps involved in transitioning from a classic data center to a cloud computing environment.Services and deployment models, cloud infrastructure components, and cloud migration considerations.Framework and domains of storage security, including implementation in storage networking.Security threats, countermeasures, and solutions for Fibre Channel (FC-SAN), IP-SAN, and NAS environments.Security in virtualized and cloud environments, monitoring, and managing information infrastructure components.Information lifecycle management (ILM), storage tiering, and cloud service management activities. .

TEXT BOOKS:

1. EMC Education Services. *Information Storage and Management*. Wiley, 2 edition, 2015. ISBN 9788126537501

2. Clark Tom. *Storage Virtualization*. Addison Wesley, 1 edition, 2018. ISBN 9780321262516

REFERENCE BOOKS:

1. Ulf Troppens, Rainer Erkens, and Wolfgang Muller. *Storage Networks Explained*. Wiley, 2 edition, 2015. ISBN 9788126557424

Deep Learning
(HH)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Machine Learning(20IT602)

Course Outcomes:

After the successful completion of the course, the students will be able to

CO1 Describe the process of training and testing an Artificial Neural Network with appropriate optimization method, loss function and activation functions.

CO2 Design a Convolutional neural network by selecting the number of filters, stride and pooling for image classification and extend pre-trained models for computer vision applications.

CO3 Describe the process of language modelling using RNN, LSTM and GRUs.

CO4 Explain Auto Encoders, Variational Auto Encoders and GANs.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
CO2	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
CO3	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
CO4	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3

UNIT - I (16 Hours)

Artificial Neural Networks: Perceptron Learning algorithm, Feedforward neural networks, activation functions, backpropagation algorithm, loss functions, Gradient Descent - Stochastic Gradient Descent (SGD), Mini Batch Stochastic Gradient Descent (MB-SGD), Optimization methods - SGD with momentum, Adaptive Gradient (AdaGrad), RMSprop, Adam, Regularization - L2 regularization, L1 regularization and dropout. Implementation of ANN using TensorFlow.

UNIT - II (15 Hours)

Convolutional Neural Networks: Convolution, filters, stride, padding, feature maps, Architecture of CNNs - input layer, convolutional layers, activation functions, pooling layers, fully connected layers, output layer, training, pre-trained CNN models, transfer learning, image classification. TensorfFow

implementation.

UNIT - III **(15 Hours)**

Sequence Models: Introduction to Sequence Modeling, word embeddings, Recurrent Neural Networks (RNNs) - Basic architecture of RNNs, Language model and sequence generation, Sentiment analysis, Vanishing and exploding gradient problems in RNNs, Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) architectures to address the vanishing gradient problem, Training RNNs.

UNIT - IV **(16 Hours)**

Generative Models: Autoencoders, Architecture and training of autoencoders for unsupervised representation learning, Variants of autoencoders - Denoising autoencoders, sparse autoencoders, and contractive autoencoders, Variational Autoencoders (VAEs), The encoder-decoder framework and the reparameterization, The role of the latent space in VAEs for generating new samples, Generative Adversarial Networks (GANs) - Understanding the GAN architecture with generator and discriminator networks.

TEXT BOOKS:

1. Francois Chollet. *Deep Learning with Python*. Manning Publishers, 2 edition, 2021. ISBN 9781617296864
2. Aurelien Geron. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly publishers, 2 edition, 2019b. ISBN 9781492032649

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2. Ian Goodfelllow, Yoshua Benjio, and Aaron Courville. *Deep Learning*. The MIT Press, 1 edition, 2020. ISBN 9780321564085. URL `http://www.deeplearningbook.org`
3. Michael Nielsen. *Neural Networks and Deep Learning*. URL `http://neuralnetworksanddeeplearning.com`

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Arshdeep Bahga and Vijay Madisetti. *Internet of Things: A Hands-on-Approach*. VPT, 1 edition, 2014a. ISBN 9788173719547.

Arshdeep Bahga and Vijay Madisetti. *Internet of Things: A Hands-on-Approach*. VPT, 1 edition, 2014b. ISBN 9788173719547.

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Imran Bashir. *Mastering Blockchain*. Packet Publishing, 1 edition, 2020. ISBN 9780321564085.

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