ACADEMIC REGULATIONS (BH23)
COURSE STRUCTURE AND
DETAILED SYLLABUS

INFORMATION TECHNOLOGY

B.Tech. Four Year Degree Course

(Applicable for the batches admitted from AY 2023-24 onwards)

VISHNU
UNIVERSAL LEARNING

BVRIT H

BVRIT HYDERABAD College of Engineering for Women
(UGC Autonomous Institution | Approved by AICTE | Affiliated to JNTUH)
(NAAC Accredited – A Grade | NBA Accredited B.Tech. (EEE, ECE, CSE and IT))
Bachupally, Hyderabad -500 090
www.bvrithyderabad.edu.in

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BVRIT HYDERABAD College of Engineering for Women

VISION

To emerge as the best among the institutes of technology and research in the country dedicated to the cause of promoting quality technical education.

MISSION

At BVRITH, we strive to

- Achieve academic excellence through innovative learning practices.
- Enhance intellectual ability and technical competency for a successful career.
- Encourage research and innovation.
- Nurture students towards holistic development with emphasis on leadership skills, life skills and human values.

CORE VALUES

1. Holistic Development
2. Excellence in Education
3. Women Empowerment
4. Integrity
5. Social Responsibility
6. Accountability and Transparency
7. Freedom of Expression

Department of Information Technology

VISION

To emerge as a center of excellence in Information Technology and to produce women technocrats, global leaders for better tomorrow.

MISSION

M1: To impart quality education and inculcate problem solving skills using latest technologies in the field of Information Technology.

M2: To encourage multidisciplinary research and consultancy projects.

M3: To promote industry academia linkage and also enhance entrepreneurship skills in women engineers.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After 3 to 6 years of graduation, the graduates of this program will be able to:

PEO-1: Develop strong analytical skills using fundamental concepts of science & engineering subjects

PEO-2: Excel in programming and critical thinking by applying core technical knowledge

PEO-3: Exhibit continuous learning related to evolving technologies in their professional career

PEO-4: Demonstrate ethical behavior, team work & leadership qualities to solve problems in broader social context

PROGRAM SPECIFIC OUTCOMES (PSOs)

The graduates of this program will be able to:

PSO-1: Formulate, simulate and use knowledge in various domains like Computer systems, data engineering, information and network security, artificial intelligence etc., thus enabling them for a better career path.

PSO-2: Provide optimized solutions using open-ended programming environment by following industry practices and strategies.

PROGRAM OUTCOMES (POs)

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.

Academic Regulations (BH23) for B.Tech. Regular Students with effect from Academic Year 2023-24

The B.Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates, admitted to the programme and fulfill all the requirements for the award of the Degree.

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

BVRIT HYDERABAD College of Engineering for Women (Autonomous) BVRITHCEW(A) offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under **Choice Based Credit System** (CBCS) with effect from the Academic Year 2023-24 onwards, in the following branches of Engineering.

S. No.	Branch Code	Branch Name
1	02	Electrical and Electronics Engineering (EEE)
2	04	Electronics and Communication Engineering (ECE)
3	05	Computer Science and Engineering (CSE)
4	12	Information Technology (IT)
5	66	Computer Science and Engineering (AI & ML)

2.0 Eligibility for admission

2.1 Admission to the undergraduate (UG) Programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (TG EAPCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire undergraduate programme in Engineering & Technology will be English only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall complete the B.Tech. Programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. course. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.

3.2 UGC / AICTE specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations / norms, which are listed below.

3.2.1 Semester scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having – 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under **Choice Based Credit System** (CBCS) and **Credit Based Semester System** (CBSS) indicated by UGC, and curriculum / course structure as suggested by AICTE are followed.

3.2.2 Credit courses

All subjects / courses are to be registered by the students in a semester to earn credits which shall be assigned to each subject / course in an L : T : P : C (Lecture periods : Tutorial periods : Practical periods : Credits) structure based on the following general pattern.

- One credit for one hour / week / semester for theory / lecture (L) courses or tutorials.
- One credit for two hours / week / semester for laboratory/ practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject / Course Classification

All subjects / courses offered for the undergraduate programme in E & T (B.Tech. degree programmes) are broadly classified as follows. The BVRITHCEW(A) has followed almost all the guidelines issued by AICTE / UGC.

S. No.	Broad Course Classification	Course Group /Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry Courses
2		ES – Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social sciences	Includes Courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent discipline / department / branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective courses related to the parent discipline / department / branch of Engineering.
6		OE – Open Electives	Elective offered by all the disciplines / departments / branches of Engineering.

7	Core Courses	Project Work	B.Tech. project or UG project or UG major Project or Project Stage I & II
8		Industry Training / Internship / Industry Oriented Mini-project / Mini- Project / Skill Development Courses	Industry Training / Internship / Industry Oriented Mini-Project / Mini-Project / Skill Development Courses
9		Real-time Research Project/ Field Based Project	Real-time Research Project / Field Based Project
10		Seminar	Seminar / Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
11	Minor courses	-	1 or 2 Credit Courses (subset of HS)
12	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

4.0 Course registration

4.1 The academic section of the college invites **'registration forms'** from students before the beginning of the semester through **'online registration'**, ensuring **'date and time stamping'.** The online registration requests for any **'current semester'** shall be completed before the commencement of SEEs (Semester End Examinations) of the **'preceding semester'**.

4.2 A student can apply for on-line registration by consulting Faculty Advisor / Counselor / Head of the Department (HoD).

4.3 A student may be permitted to register for all the subjects / courses in a semester as specified in the course structure with maximum additional subject (s) / course (s) limited to 6 Credits (any 2 elective subjects), based on progress and SGPA / CGPA, and completion of the '**prerequisites'** as indicated for various subjects / courses, in the department course structure and syllabus contents.

4.4 Choice for '**additional subjects / courses'**, not more than any 2 elective subjects in any semester, must be clearly indicated.

4.5 If the student submits ambiguous choices or multiple options or erroneous entries during online registration for the subject (s) / course (s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject / course in that category will be taken into consideration.

4.6 Subject / course options exercised through online registration are final and cannot be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject / course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within a week after the commencement of class-work for that semester.

4.7 Dropping of subjects / courses may be permitted, only after obtaining prior approval from the faculty counselor and HoD **'within a period of 15 days'** from the beginning of the current semester.

4.8 **Open Electives:** The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by her own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses, etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat / should not match with any category (Professional Core, Professional Electives, Mandatory Courses, etc.) of subjects even in the forthcoming semesters.

4.9 **Professional Electives:** The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 Subjects / courses to be offered

5.1 An Elective Course may be offered to the students, only if a minimum of 30 students opt for it. The maximum strength of a section is limited to 75.

5.2 In case of options coming from students of other departments / branches / disciplines (not considering **open electives**), first priority shall be given to the student of the '**parent department'**.

6.0 Attendance requirements

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the fortnightly upload of attendance to the Academic Section.**

6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the Academic Council on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable for condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in no case be condoned.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks, etc.) of that semester. They will not be promoted to the next semester. They may seek re-registration for all those subjects registered in that semester, in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and / or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the same set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if she (i) does not submit a report on Industry Oriented Mini Project / Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such **'one re-appearance'** evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

7.4 A student (i) shall register for all courses / subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and

CGPA≥5.0 (at the end of 8 semesters), (iv) **passes all the mandatory courses**, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme)**, and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5 If a student registers for '**extra subjects'** (in the parent department or other departments / branches of Engineering.) other than those listed subjects totalling to 160 credits as specified in the course structure of her department, the performance in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1-7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure 'C' grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfilment of academic requirements.** The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which the student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which the student has been readmitted shall be applicable to her.

8.0 Evaluation-Distribution and Weightage of marks

8.1 The performance of a student in every subject / course (including practicals and Project Stage - I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
   a. Part-A: Objective / quiz paper for 10 marks.
   b. Part-B: Descriptive paper for 20 marks.

The objective / quiz paper is set with multiple choices, fill - in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)
3. Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), her performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

There is NO Computer Based Test (CBT) for BH23 regulations.

The details of the end semester question paper pattern are as follows:

8.2.1 The Semester End Examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part-A** for 10 marks, ii) **Part-B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

8.2.2 For the subject, **Computer Aided Engineering Graphics**, the Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) evaluation pattern is same as for other theory subjects.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components / procedure, expected outcome) which shall be evaluated for 10 marks
2. 10 marks for viva-voce **(**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Report / Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed by the Controller of Examinations / Chief Superintendent on the recommendation of BoS chairman of the concerned department.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment / program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment / program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), her performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

8.4 The evaluation of courses having ONLY internal marks in I Year I Semester and II Year II Semester is as follows:

1. I Year I Semester course (*ex.*, ***Elements of EEE / ECE / CSE*** *etc*): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

   For CSE / IT and allied branches the Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts **i) Part – A** for 20 marks, ii) **Part–B** for 20 marks with a total duration of 2 hours.
   Part A: Objective / quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 20 marks. **Part B:** Descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.
   The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce / PPT / Poster Presentation / Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.
   For all other branches, the Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:
   a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/ procedure, expected outcome) which shall be evaluated for 10 marks
   b) **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
   c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for15 marks.
   d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software/Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (iii) secures less than 40% marks in this course.

8.5 There shall be Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation / semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.6 The UG project shall be initiated in the IV Year I Semester and the duration of the project work is one year. The student must present Project Stage - I during IV Year I Semester before II Mid examinations, in consultation with her Supervisor, the title, objective and plan of action of her Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start her project work.

8.7 UG project work shall be carried out in two stages: Project Stage - I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage - II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear for the above evaluation, when it is scheduled again; if she fails in such **'one reappearance'** evaluation also, she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage –II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of the 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project / Internship / SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, Controller of Examinations / Chief Superintendent select an external examiner from the list of experts in the relevant branch submitted by the BoS Chairman of the concerned department.

A student, who has failed, may reappear once for the above evaluation, when it is scheduled again; if the student fails in such **'one reappearance'** evaluation also, she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 A student shall be given only one time chance to re-register for a maximum of two subjects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce / PPT / Poster presentation / Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.

A student must re-register for the failed subject (s) for 40 marks within four weeks of commencement of the class work in next academic year.

In the event of the student taking this chance, her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

8.11 For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject / course. These marks should also be uploaded along with the internal marks of other subjects.

8.12 No marks or letter grades shall be allotted for mandatory / non-credit courses. Only Pass / Fail shall be indicated in Grade Card.

9.0 Grading procedure

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory / Practicals, Seminar, Industry Oriented Mini Project, and Project Stage-I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

9.3 A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a **'supplementary student'** in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and she is deemed to have '**failed**'. A student will be required to reappear as a **'supplementary student'** in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade

secured in that subject/ course. The corresponding **'credit points'** (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits….for a course

9.7 A student passes the subject / course only when **GP ≥ 5 ('C' grade or above)**

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (∑CP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ …. for each semester}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects '**registered'** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in all registered courses in all semesters, and the total number of credits registered in all the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \quad \text{… for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S≥2),

where '**M'** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered'** i.e., from the 1^{st} semester onwards up to and inclusive of the 8^{th} semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course / Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8=32
Course 2	4	O	10	4 x 10 =40
Course 3	4	C	5	4 x 5=20
Course 4	3	B	6	3 x 6=18
Course 5	3	A+	9	3 x 9=27
Course 6	3	C	5	3 x 5=15
	21			152

SGPA = 152 / 21 = 7.24

Illustration of calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course1	3	A	8	24
I	Course2	3	O	10	30
I	Course3	3	B	6	18
I	Course4	4	A	8	32
I	Course5	3	A+	9	27
I	Course6	4	C	5	20
II	Course7	4	B	6	24
II	Course8	4	A	8	32
II	Course9	3	C	5	15
II	Course10	3	O	10	30
II	Course11	3	B+	7	21
II	Course12	4	B	6	24
II	Course13	4	A	8	32
II	Course14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518 / 69 = 7.51

The above illustrated calculation process of CGPA will be followed for each

subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off'** values of the CGPAs will be used.

9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting she passed her last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if she secures a GP ≥ 5.0 (**'C'** grade or above) in every subject / course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and she shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.0 (**'C'** grade or above) for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.), credits earned. **There is No exemption of credits in any case**.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of degree

12.1 A student who registers for all the specified subjects / courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. degree in the chosen branch of Engineering selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the undergraduate programme) ≥ 8.00, and fulfilling the following conditions-shall be placed in '**first class with distinction'**.

However, she

(i) Should have passed all the subjects / courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA ≥ 8.00 shall be placed in **'First Class'.**

12.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 7.00 but < 8.00 shall be placed in **'First Class'.**

12.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00, shall be placed in '**Second Class'**.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6.00, shall be placed in '**Pass Class**'.

12.7 A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

12.9 Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) up to B.Tech. II Year II Semester, if the student wants to exit the 4-Year B.Tech. Programme and *requests for the 2 –Year* B.Tech. (*UG) Diploma Certificate.*
2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B.Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B.Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, she should register for the subjects / courses in III Year I Semester before commencement of class work for that semester.*
3. *The students, who exit the 4-Year B.Tech. Programme after II Year of study and wish to re-join the B.Tech. Programme, must submit the 2 - Year* B.Tech. (*UG) Diploma Certificate awarded to her, subject to the eligibility for completion of Course / Degree.*
4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year Programme).

13.0 Withholding of results

13.1 If the student has not paid the fees to the college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

A. **For students detained due to shortage of attendance:**

1. A student, who has been detained in I Year of R18/R22 Regulations due to lack of attendance, shall be permitted to join I Year I Semester of BH23 Regulations and she is required to complete the study of B.Tech. Programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student, who has been detained in any semester of II, III and IV years of R18/R22 regulations for want of attendance, shall be permitted to join the corresponding semester of BH23 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The BH23 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. **For students detained due to shortage of credits:**

3. A student of R18/R22 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of BH23 Regulations only after acquiring the required number of credits as per the corresponding regulations of her first admission. The total credits required are 160 including both R18/R22 & BH23 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The BH23 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. **For readmitted students in BH23 Regulations:**

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of her study including BH23 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to BH23 Regulations and has any subject with 80% of syllabus common with her previous regulations, that particular subject in BH23 Regulations will be substituted by another subject to be recommended by the Academic Council (AC), and approved by Governing Body (GB).

Note: If a student readmitted to BH23 Regulations and has not studied any subjects / topics in her earlier regulations of study which is prerequisite for further subjects in BH23 Regulations, the concerned department HoD shall conduct remedial classes to

cover those subjects / topics for the benefit of the students.

15.0 Student Transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 The students seeking transfer to BVRITHCEW(A) from various other Universities / Institutions have to pass the failed subjects which are equivalent to the subjects of BVRITHCEW(A), and also pass the subjects of BVRITHCEW(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of BVRITHCEW(A), the students have to study those subjects in BVRITHCEW(A) in spite of the fact that those subjects are repeated.

15.3 The BVRITHCEW(A) will provide one chance to write the internal examinations in the equivalent subject (s) to the students transferred from other universities / institutions, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

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

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

16.3 The AC may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the AC.

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Academic Regulations (BH23) for B.Tech. (Lateral Entry Scheme) from the AY 2024-25

1. **Eligibility for award of B.Tech. Degree (LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5.0 from II year to IV year B.Tech. Programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rules**

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

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

7. LES students are not eligible for 2-Year B.Tech. Diploma Certificate.

Malpractices Rules

Disciplinary Action for Malpractices / Improper Conduct in Examinations

	Nature of Malpractices / Improper conduct	Punishment
	If the student:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student 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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	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 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 subject only of all the students involved. In case of an outsider, she will be handed over to the police and a case is registered against her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and allot her subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The 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 forfeiture of seat. If the imposter is an outsider, she will be handed over to the police and a case is registered against her.

4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The 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 forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting her to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant -superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walkout, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to her person or to any of her 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 her relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects 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 is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The 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 forfeiture of seat.

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

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

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Academic Regulations for B.Tech. with Minor program

1. Introduction

The philosophy behind Engineering as an academic discipline has been to orient the knowledge seekers in a manner that shatters the theoretical boundaries and pushes them into the realms of a practical world view.

The emphasis of BVRITHCEW has always been to orient the students towards the technologies that shall drive the world in the years to come; with this philosophy the Institution has decided to launch the **Bachelor of Technology in a particular branch with minor in a specified program** (Ex. B.Tech. in ECE / EEE with Minor in AI&ML) from the AY 2025-26 onwards.

The **Bachelor of Technology (B.Tech.) with Minor** program focuses on the fundamental principles of multiple Engineering disciplines, critical & analytical thinking and the ability to develop a distinctive approach to the interdisciplinary problems.

2. Objectives

The key objectives of offering B.Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in inter-disciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging technologies / thrust areas of Engineering.

3. Minor courses and the offering departments

S. No.	Minor Program	Eligible branch of students	@Offering Department	Award of Degree
1.	Data Science	All branches, except B.Tech. in CSE (Data Science) / B.Tech. (Data Science)	CSE	"B.Tech.in branch name with Minor in Data Science"
2.	IOT	All branches, except B.Tech. in CSE (IOT) / B.Tech. (IOT)	ECE	"B.Tech. in branch name with Minor in IOT"
3.	Innovation and Entrepreneurship	All branches	Management Science / MBA	"B.Tech. in branch name with Minor in Innovation and Entrepreneurship"

Note: @As per AICTE guidelines.

4. Academic Regulations for B.Tech. Degree with Minor programs

1. The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B.Tech. program.
2. For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). All these 18 credits need to be completed in III year and IV year only.
3. After registering for the Minor program, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B. Tech degree in the concerned branch.
4. There is no transfer of credits from Minor program courses to regular B.Tech. degree course & vice versa.
5. These 18 credits are to be earned from the additional courses offered by the host department in the college as well as from the MOOCs platform.
6. **For the course selected under MOOCs platform following guidelines may be followed:**
    a) Prior to registration of MOOCs courses, formal approval of the courses, by the Academic Council is essential. Academic Council considers the parameters viz., the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc. before the issue of approval.
    b) Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in minor grade memo.
    d) Any expenses incurred for the MOOCs courses are to be met by the students only.
7. The choice to opt/ take a Minor program is purely on the choice of the students.
8. The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at anytime; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.
9. The student can choose only one Minor program along with her basic engineering degree. **A student, who chooses an Honors program, is not eligible to choose a Minor program and vice-versa.**
10. The B.Tech. with a Minor program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can

register for the Minor program if they fulfil the eligibility criteria.

11. A student can graduate with a Minor if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Minor program.
12. The institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise.
13. The concerned department shall prepare the time-tables for each Minor course offered at without any overlap / clash with other courses of study in the respective semesters.

5. Eligibility conditions for the student to register for Minor course

a) A student can opt for B.Tech. degree with Minor program if she has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

6. Registration for the courses in Minor Program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum no. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

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Academic Regulations (BH23) for B.Tech. with Honors program

1. Objectives

The key objectives of offering B.Tech. with Honors program are:

- To expand the domain knowledge of the students laterally and vertically.
- To increase the employability of undergraduate students with expanded knowledge in one of the core Engineering disciplines.
- To provide an opportunity for the students to pursue their higher studies in wider range of specializations.

2. Academic Regulations for B.Tech. Honors degree

1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B.Tech. program.
2) For B.Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B.Tech. degree). All these 20 credits need to be completed in III year and IV year only.
3) After registering for the Honors program, if a student is unable to pass all courses in first attempt and earn the required 20 credits, she shall not be awarded Honors degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B.Tech. degree in the concerned branch.
4) There is no transfer of credits from courses of Honors program to regular B.Tech. degree course & vice versa.
5) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCs platform.
6) **For the courses selected under MOOCs platform following guidelines may be followed:**
    a) Prior to registration of MOOCS courses, formal approval of the courses, by the Academic Council is essential. The Academic Council considers the parameters viz., the institute / agency, offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc., before the issue of approval
    b) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the Institution.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in the Honors grade memo.
    d) Any expenses incurred for the MOOCS courses are to be met by the students only.

7) The choice to opt / take the Honors program is purely on the choice of the students.

8) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at anytime; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.

9) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

10) The B.Tech. with Honors program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can register for the Honors program if they fulfil the eligibility criteria.

11) A student can graduate with Honors if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Honors program.

12) The Institution shall maintain a record of students registered and pursuing their Honors programs branch-wise.

13) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap / clash with other courses of study in the respective semesters.

3. Eligibility conditions of the students for the Honors degree

a) A student can opt for B.Tech. degree with Honors, if she passed all subjects in first attempt in all the semesters till the results announced and maintaining 7.5 or more CGPA.

b) If a student fails in any registered course of either B.Tech. or Honors in any semester of four years program, she will not be eligible for obtaining Honors degree. She will be eligible for only B.Tech. degree

c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year I Semester (V Semester), is mandatory.

d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the CGPA secured by the students till II year I semester.

e) **The department concerned should be preferably NBA accredited and shall offer at least one M.Tech. Program.**

f) Successful completion of 20 credits earmarked for Honors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B.Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.

g) For CGPA calculation of B.Tech. course, the 20 credits of Honors program will not be considered.

4. Registration for the course in Honors program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum no. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of the course are:

S. No.	Year /Semester	Course to be chosen from/studied	Mode of Learning	No. of Credits
1	III-I	PE-I or PE-II	Blended/Conventional	3
2	III-II	Research Methodologies	Conventional	3
3	III-II	PE-III	Conventional	3
4	IV-I	PE-IV	Conventional	3
5	IV-I	PE-V	Conventional	3
6	IV-II	Technical Paper writing	Under the mentorship of a supervisor	2
7	IV-II	PE-VI or an Inter-disciplinary subject as suggested by the Academic Council	MOOCs	3
	Total Credits			20

Note:

i. Professional Elective (PE) course should be selected (which is not studied) from each Professional Electives' list provided in regular B.Tech. course.

ii. Courses can be chosen as in above table.

1. **Technical paper writing:**

   a) The student shall take up a problem / topic of engineering branches (inter-disciplinary nature) and apply the knowledge which they acquired while pursuing their engineering branch. It is expected to analyze, design and develop an application for the identified problem and write a technical paper / document.

   Alternatively, the student i) shall identify a research topic, analyze the problem, carryout the experiments, write a technical paper and publish in / communicate for a Scopus indexed journal / any journal with decent reputation or ii) Demonstrate a talent / an idea / development of an innovative product.

   b) The evaluation shall be done by the same committee which is constituted for project evaluation, along with the final semester project work.

   c) The students should start exploration for the Technical Paper Writing immediately after the semester exams of III-II semester. Only the evaluation part shall be carried in IV-II semester.

2. The institute shall offer a course on Research Methodologies by combining the students of all branches (if the number of students is more, multiple parallel sessions may be conducted). The time slots in the time-tables of respective branches should be aligned. Both the CIE and SEE for the Research Methodologies course shall be done as regular B.Tech. courses.

3. If the blended course option is chosen, for the subject in III-I semester, the learning should be partially in online mode and partially in offline mode. The external evaluation shall be done as regular B.Tech. courses; however, for the CIE component, online assessment should also be taken into account while finalizing the internal marks by the course teacher.

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Academic Regulations for B.Tech. - MOOCs

1. **Introduction**

   As per NEP, to inculcate the habit of self-learning and in compliance with the UGC guidelines, MOOC (Massive Open Online Courses) have been introduced.

   The proposed MOOCs would be additional choices, proposed by concern department BoS (having credits >= the required credits) and approved by the Academic Council, in all the elective group courses subjected to the availability in the MOOC platforms during the respective semesters.

   After the approval, at the beginning of the semester, the concerned departments shall declare the list of permitted courses to the student.

   The progress of the MOOCs shall be monitored by the course coordinator of the department, nominated by the concerned HoD.

2. **Eligibility**

   A student is eligible to register for OE / PE in Third Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year I Semester. Similarly, the eligibility to register for OE / PE, in the Third Year Second semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year II Semester and to register for OE / PE, in the Fourth Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to III Year I Semester.

3. **Course Registration**

   Students interested in pursuing MOOCs shall register the course title at their department office before the start of the semester.

   A student can register at most two MOOCs throughout the course of study after approval from Faculty Advisor / Counselor / HoD.

   Detailed guidelines regarding credit transfer of the courses pursued through MOOC (NPTEL-SWAYAM) shall be issued time to time by the Institution.

Academic Regulations for B.Tech. - Acceleration of Course Work

1. **Introduction**

In order to allow the bright and motivated students, a provision is made to complete the final semester three elective subjects in advance. These subjects are offered through MOOCs / additional subjects and credit transfer is permitted.

These credits are shown in the Final Semester Grade card in order to calculate SGPA and CGPA. This provision is made to allow the students for industry internship or to undertake projects in industry in the final semester.

2. **Eligibility**

A student is eligible to register for OE / PE in Third Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year I Semester. Similarly, the eligibility to register for OE / PE, in the Third Year Second semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year II Semester and to register for OE / PE, in the Fourth Year First semester by having a CGPA of $\geq$ 6.5 without any active backlogs up to III Year I Semester.

3. **Course Registration**

A student can register at most two additional PE / OE in a semester after approval from Faculty Advisor / Counselor / HoD.

These additional courses have to be completed either through regular class work / MOOCs as per the directions of College Academic Committee.

The list of electives offered will be notified by the departments at the time of course work registration.

COURSE STRUCTURE (BH23 Regulations)
Applicable from AY 2023-24 Batch

I Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	MA101BS	Matrices and Calculus	3	1	0	4
2	PH102BS	Applied Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	0	0	3
4	ME104ES	Engineering Workshop	0	1	3	2.5
5	EE105ES	Basic Electrical Engineering	2	0	0	2
6	CS106ES	Elements of Computer Science & Engineering	0	0	2	1
7	PH107BS	Applied Physics Laboratory	0	0	3	1.5
8	CS108ES	Programming for Problem Solving Lab	0	0	2	1
9	EE109ES	Basic Electrical Engineering Laboratory	0	0	2	1
		Induction Programme				
		Total	11	3	12	20

I Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	CH202BS	Engineering Chemistry	3	1	0	4
3	ME203ES	Computer Aided Engineering Graphics	1	0	4	3
4	EC204ES	Electronic Devices and Circuits	2	0	0	2
5	EN205HS	English for Skill Enhancement	2	0	0	2
6	CS206ES	Python Programming Laboratory	0	1	2	2
7	CH207BS	Engineering Chemistry Laboratory	0	0	2	1
8	EN208HS	English Language and Communication Skills Laboratory	0	0	2	1
9	CS209ES	IT Workshop	0	0	2	1
		Total	11	3	12	20

II Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	IT301PC	Digital Electronics	3	0	0	3
2	CS302PC	Data Structures	3	0	0	3
3	CS303PC	Discrete Mathematics	3	0	0	3
4	CS304PC	Database Management Systems	3	0	0	3
5	IT305PC	Introduction to IoT	2	0	0	2
6	CS306PC	Data Structures Lab	0	0	3	1.5
7	IT307PC	Digital Electronics Lab	0	0	2	1
8	CS308PC	Database Management Systems Lab	0	0	2	1
9	CS309PC	Data Visualization- R Programming/ Power BI	0	0	2	1
10	IT310PC	Internet of Things Lab	0	0	3	1.5
11	*MC311	Environmental Science	3	0	0	0
Total			17	0	12	20

II Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	IT401PC	Computer Organization & Microprocessor	3	0	0	3
2	MA402BS	Computer Oriented Statistical Methods	3	1	0	4
3	CS403PC	Operating Systems	3	0	0	3
4	SM404MS	Business Economics & Financial Analysis	3	0	0	3
5	IT405PC	Java Programming	2	0	0	2
6	CS406PC	Operating Systems Lab	0	0	2	1
7	CS407PC	Node JS/ React JS/ Django	0	0	2	1
8	IT408PC	Real-time Research Project/ Societal Related Project	0	0	4	2
9	IT409PC	Java Programming Lab	0	0	2	1
10	MC410	Gender Sensitization Lab	0	0	2	0
Total			14	1	12	20

III Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	IT501PC	Software Engineering	3	0	0	3
2	IT502PC	Data Communications and Computer Networks	3	1	0	4
3	IT503PC	Algorithm Design and Analysis	3	0	0	3
4		Professional Elective - I	3	0	0	3
5		Professional Elective - II	3	0	0	3
6	IT504PC	Software Engineering & Computer Networks Lab	0	0	2	1
7		Professional Elective - I Lab	0	0	2	1
8	EN505HS	Advanced English Communication Skills Lab	0	0	2	1
9	CS506PC	UI design- Flutter	0	0	2	1
10	MC508	Intellectual Property Rights	3	0	0	0
Total			18	1	8	20

III Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	IT601PC	Automata Theory and Compiler Design	3	0	0	3
2	IT602PC	Machine Learning	3	0	0	3
3	IT603PC	Embedded Systems	3	0	0	3
4	IT604PC	Compiler Design Lab	0	0	2	1
5		Professional Elective –III	3	0	0	3
6		Open Elective-I	3	0	0	3
7	IT605PC	Embedded Systems Lab	0	0	2	1
8	IT606PC	Machine Learning Lab	0	0	2	1
9	IT607PC	Industrial Oriented Mini Project/ Internship/ Skill Development Course (Big data-Spark)	0	0	4	2
10	MC608	Constitution of India	3	0	0	0
Total			18	0	10	20

IV Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	IT701PC	Information Security	3	0	0	3
2	IT702PC	Cloud Computing	3	0	0	3
3		Professional Elective -IV	3	0	0	3
4	SM703MS	Organizational Behavior	3	0	0	3
5		Open Elective-II	3	0	0	3
6	IT703PC	Information Security Lab	0	0	2	1
7	IT704PC	Cloud Computing Lab	0	0	2	1
8	IT705PC	Project Stage – I	0	0	6	3
Total			15	0	10	20

IV Year II Semester

S. No.	Code	Title	L	T	P	Credits
1		Professional Elective -V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	IT801PC	Project Stage – II including Seminar	0	0	22	11
Total			9	0	22	20

Professional Electives

PE – I	IT511PE	Full Stack Development
	IT512PE	Data Mining
	IT513PE	Mobile Application Development
	IT514PE	Software Testing Methodologies
PE - II	IT521PE	Computer Graphics
	IT522PE	Information Retrieval Systems
	IT523PE	Distributed Databases
	IT524PE	Pattern Recognition
PE-1 Lab	IT531PE	Full Stack Development Lab
	IT532PE	Data Mining Lab
	IT533PE	Mobile Application Development Lab
	IT534PE	Software Testing Methodologies Lab
PE - III	IT611PE	Biometrics
	IT612PE	E-Commerce
	IT613PE	Data Analytics
	IT614PE	Principles of Programming Languages
PE - IV	IT711PE	Human Computer Interaction
	IT712PE	High Performance Computing
	IT713PE	Quantum Computing
	IT714PE	Wireless Networks & Mobile Computing
PE - V	IT811PE	Intrusion Detection Systems
	IT812PE	Blockchain Technology
	IT813PE	Deep Learning
	IT814PE	Software Process and Project Management
PE -VI	IT821PE	Natural Language Processing
	IT822PE	Business Intelligence
	IT823PE	Augmented Reality and Virtual Reality
	IT824PE	Cyber Forensics

Open Electives

Open Electives	Department Offering	Course Code	Course Name
OE-I	EEE	EE600OE	Renewable Energy Sources
		EE601OE	Green Energy Technologies
		EE602OE	Fundamentals of Electric Vehicles
	ECE	EC600OE	Microcontrollers
		EC601OE	Fundamentals of IoT
		EC602OE	VLSI Design
	CSE/ CSE (AIML) /IT	CS600OE	Problem Solving using Data Structure
		CS601OE	Introduction to Java Programming
		CS602OE	Fundamentals of AI
OE-II	EEE	EE700OE	Utilization of Electrical Energy
		EE701OE	Electric Drives and Control
		EE702OE	Principles of Power Systems
	ECE	EC700OE	Electronic Sensors
		EC701OE	Digital Image Processing
		EC702OE	Principles of Communications
	CSE/ CSE (AIML) /IT	CS700OE	Scripting Languages
		CS701OE	Database Management Systems
		CS702OE	Machine Learning
OE-III	EEE	EE800OE	Basics of Power Plant Engineering
		EE801OE	Energy Sources and Applications
		EE802OE	Battery Management Systems
	ECE	EC800OE	Electronic Measurements and Instrumentation
		EC801OE	Embedded System Design
		EC802OE	FPGA based System Design
	CSE/ CSE (AIML) /IT	CS800OE	Operating Systems
		CS801OE	Software Engineering
		CS802OE	Computer Networks

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
MA101BS	**Matrices and Calculus**	3	1	0	4

Prerequisite: Mathematical Knowledge at pre-university level

Course Description: The course contains various topics related to Rank of the Matrix and their related properties, Echelon form, Normal form, Solving linear system of equations, Eigen values and vectors, Reduction of Quadratic form to canonical forms, Mean value theorems, Improper Integration and their applications of beta, gamma functions, Maxima and minima of functions of two variables and three variables, Partial Differentiation, Evaluation of Double Integrals (Cartesian and polar coordinates), Change of order of integration, Evaluation of triple Integrals.

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

C101.1: Apply matrix techniques to solve system of linear equations.
C101.2: Find the Eigen values and Eigen vectors and reduce the Quadratic form to canonical Form.
C101.3: Apply Mean value theorems for given functions
C101.4: Evaluate the improper integrals using Beta and Gamma functions
C101.5: Find the extreme values of functions of two variables with/ without constraints.
C101.6: Evaluate the multiple integrals and apply the concept to find areas, volumes

Unit – I Matrices
Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Unit - II Eigen Values and Eigen Vectors
Linear Transformation and Orthogonal Transformation: Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit– III Single Variable Calculus
Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Maclaurin Series. Definition of Improper Integrals: Beta, Gamma functions and their properties, Relation between Beta& Gamma functions and their applications.

Unit – IV Multivariable Calculus (Partial Differentiation and Applications)
Definitions of Limit and continuity. Partial Differentiation: Introduction to Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers**.**

Unit – V Multivariable Calculus (Integration)
Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables (Cartesian to polar) for double integrals. Evaluation of triple integrals (Cartesian Coordinates) Applications: Areas (by double integrals) and volumes (by triple integrals).

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, 36th Edition, 2010, Khanna Publishers.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5th Edition, 2016, Narosa Publications.

REFERENCE BOOKS

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, 2002, Pearson.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, Reprint.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
PH102BS	**Applied Physics**	3	1	0	4

Course Description: This course consists of principles of Quantum mechanics with advanced topics in their respective engineering branches. It introduces the principles of semiconductors and some widely used semiconductor devices for various applications. It introduces fundamental concepts related to the dielectric and magnetic materials. It introduces the importance of Lasers, optical fibers with propagation characteristics. It also introduces the fundamentals of nanotechnology and various material growth and characterization techniques.

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

C102.1: Understand the physical world from a fundamental point of view by the concepts of quantum mechanics.
C102.2: Identify the role of semiconductor devices in science and technology applications.
C102.3: Explore the fundamental properties of dielectric and magnetic materials for device applications.
C102.4: Understand various aspects of Lasers and their applications in diverse fields.
C102.5: Explain the principle of optical fibers and their significance in communication
C102.6: Appreciate the features and applications of nanomaterials.

Unit – I Principles of Quantum Mechanics

Quantum Mechanics: Introduction, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law (qualitative) - Planck's radiation law - photoelectric effect – De- Broglie hypothesis - matter waves - Davisson and Germer experiment – Heisenberg uncertainty principle – time independent Schrodinger wave equation - Born interpretation of the wave function - particle in a 1-D potential well.

Unit – II Semiconductors and Devices

Intrinsic and extrinsic semiconductors – Hall effect – construction, working principle and characteristics of P-N Junction diode, Zener diode and Bipolar Junction Transistor (BJT) – direct and indirect band gap semiconductors – LED – photodiodes: PIN photodiode, avalanche photodiode (APD) and solar cells: structure, materials, working principle and characteristics.

Unit – III Dielectric and Magnetic Materials

Dielectric Materials: Basic definitions - types of polarizations (qualitative) - ferroelectric, piezoelectric and pyroelectric materials – applications - liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Origin of the magnetic moment - classification of magnetic materials - domain theory of ferromagnetism - hysteresis - soft and hard magnetic materials - magnetostriction, magnetoresistance – applications – magnetic field sensors and multiferroics.

Unit – IV Lasers and Fiber Optics

Lasers: Laser beam characteristics - three quantum processes - Einstein coefficients and their relations - laser components - lasing action - pumping methods - Types of Lasers: Ruby laser, Nd: YAG laser, He-Ne laser, CO_2 laser - semiconductor laser – applications.

Fiber Optics: Introduction - total internal reflection - construction of optical fiber - acceptance angle - numerical aperture - classification of optical fibers - losses in optical fiber - optical fiber for communication system – advantages and applications.

Unit – V Nanotechnology

Introduction - Nanoscale, surface-to-volume ratio, quantum confinement - bottom-up approach: sol-gel and precipitation methods – top-down approach: ball milling, physical vapor deposition (PVD) and chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

TEXT BOOKS

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, A Text book of Engineering Physics, 11th Edition 2019, S. Chand Publications.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, 2nd Edition, 2022, Cengage Learning,
3. Donald A, Neamen, Semiconductor Physics and Devices- Basic Principle, 4th Edition, 2021, Mc Graw Hill.
4. Narasimha Reddy Katta, Essentials of Nanoscience & Nanotechnology, 1st Edition, 2021, Typical Creatives NANO DIGEST.

REFERENCE BOOKS

1. H.C. Verma, Quantum Physics, 2nd Edition 2012, TBS Publication.
2. Halliday, Resnick and Walker, Fundamentals of Physics, 11th Edition, 2018, John Wiley Sons.
3. A.K. Bhandhopadhya - Nano Materials. 1st Edition, 2007, New Age International.

B. Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CS103ES	**Programming for Problem Solving**	3	0	0	3

Course Description: The course contains topics related to fundamentals of problem solving using structured programming approach. It introduces standard programming techniques like alternation, iteration and recursion using C. It aims on using arrays, pointers and structures to formulate algorithms and programs. The course also covers files, searching and sorting problems.

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

CS103.1: Understand the basics of algorithms and flowcharts for solving problems
CS103.2: Implement control structures using C programming language
CS103.3: Apply the knowledge of derived data types & use of preprocessor commands to solve problems
CS103.4: Explore dynamic memory allocation and file handling functions using C
CS103.5: Develop reusable code using the concept of modular programming.
CS103.6: Demonstrate various searching and sorting techniques along with their time complexities

Unit – I Introduction to Programming

Introduction to Programming:

Compilers, compiling and executing a program. Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudocode with examples, Program design and structured programming.

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

Unit – II Arrays, Strings, Structures and Pointers

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings.

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self referential structures, usage of self referential structures in linked list (no implementation) Enumeration data type.

Unit – III Preprocessor and File handling in C

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

Unit – IV Functions and Dynamic Memory Allocation

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

Unit – V Searching and Sorting

Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

TEXT BOOKS

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, 3rd Edition Cengage Learning,
3. B.W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI/Pearson Education.

REFERENCE BOOKS

1. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill.
2. Yashavant Kanetkar, Let Us C, 18th Edition, BPB.
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, 4th Edition, McGraw-Hill.
5. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivert, Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
ME104ES	**Engineering Workshop**	0	1	3	2.5

Course Description: Engineering workshop demonstrates about how different working tools, machinery, and equipment are operated, applied, and used. Acquire the essential knowledge necessary to manufacture a variety of engineering products. To provide students with hands-on practice using a variety of engineering materials, tools, equipment, and processes that is widely utilized in the engineering field. To encourage optimism, cooperation, accuracy, and safety at work. To gain knowledge of various hand-powered tools, their uses, and how they function.

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

C104.1: Distinguish carpentry, fitting, black smithy and welding manufacturing processes.

C104.2: Develop house hold and engineering goods from metallic sheets in tin smithy.

C104.3: Apply basic electrical engineering knowledge for house wiring practice.

C104.4: Construct a sand mould for a given pattern using foundry tools.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

Cycle 1:

1. Tin Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
2. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
3. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
4. Black Smithy – (Round to Square, Fan Hook and S-Hook

Cycle 2:

5. Fitting – (Square fit, V-Fit, & Dovetail Fit)
6. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
7. Welding Practice – (Arc Welding & Gas Welding)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting, Power tools in construction and Wood Working.

TEXT BOOKS

1. Kannaiah P., Narayana K.L., Workshop Manual, Second Edition, 2013, Scitech.
2. Venkat Reddy, Workshop Manual, Sixth Edition, 2008, BSP.

REFERENCE BOOKS

1. Juneja B. L., Workshop Practice, Second Edition, 2016, Cengage Learning India Pvt. Limited.
2. Venugopal K., Prabhu Raja V., Sreekanjana G., Workshop Manual, First Edition, 2012, Anuradha

B.Tech. I Year I Semester

Course code	Course Title	L	T	P	Credits
EE105ES	**Basic Electrical Engineering**	2	0	0	2

Course Description: Basic Electrical Engineering is a professional engineering subject that deals with the study and application of electrical engineering. A good grasp of the fundamentals of Electrical Engineering is an absolute necessity to become a good engineer in any discipline. Our day-to-day life is completely dependent on electricity. A reasonable understanding on the basics of electricity is therefore important for every engineer. This course deals with the basics of DC and AC circuit analysis under steady state and transient conditions. The basic knowledge on the constructional details and working principles of the commonly used DC and AC machines are included in the course. This course also gives an overview of the components in electrical installations.

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

C105.1: Analyze DC electric circuits with basic electrical components.
C105.2: Analyze single phase and three phase AC circuits.
C105.3: Illustrate the performance of transformers.
C105.4: Explain the construction of DC and AC machines
C105.5: Explain the working Principle of DC and AC machine
C105.6: Differentiate various components in electrical installations

Unit – I D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation - Network reduction techniques, Mesh Analysis, Super- Mesh Analysis, Nodal Analysis and Super-Node Analysis. Superposition, Thevenin and Norton Theorems. (Problems with independent sources).

Time-domain analysis of first-order RL and RC circuits.

Unit – II A.C. Circuits

Representation of sinusoidal waveforms, peak, rms, and average 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 in series R-L-C circuit.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

Unit – III Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Working principle of Auto-transformer and three-phase transformer connections.

Unit – IV Electrical Machines

Construction and working principle of dc motor, performance characteristics of dc shunt motor. Generation of rotating magnetic field, Construction and working principle of a three-

phase induction motor, Significance of torque-slip characteristics, Single-phase induction motor - Capacitor-start Capacitor run motor (elementary treatment only). Construction and working principle of synchronous generator.

Unit – V Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Types of Cables, Earthing. Elementary calculations for energy consumption, power factor improvement, Applications of Batteries as Energy storage devices.

TEXT BOOKS

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", 4th Edition, 2019, Tata McGraw Hill.
2. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", 2nd Edition, 2019, S. Chand.

REFERENCE BOOKS

1. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", 2nd Edition, 2008, Tata McGraw Hill.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", 2009, McGraw Hill.
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", 1st Edition, 2012, Oxford.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, 2021, McGraw Hill.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", 2nd Edition, 1996, Oxford University Press.
6. E. Hughes, "Electrical and Electronics Technology", 2010, Pearson.
7. V. D. Toro, "Electrical Engineering Fundamentals", 1989, Prentice Hall India.

B.Tech. I Year I Semester

Course code	Course Title	L	T	P	Credits
CS106ES	**Elements of Computer Science and Engineering**	0	0	2	1

Course Description: To provide an overview of the subjects of computer science and engineering. Discuss about software installation and hardware assembling. Advanced topics related to computer science are discussed.

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

C106.1: Understand the purpose of various components of a basic computer, significance of essentials in software development.
C106.2: Understand the functionalities of various operating systems.
C106.3: Understand the basics of organization and management of databases.
C106.4: Understand the types of connectivity, applications and security issues, fundamentals of self - driven systems.

Unit – I Basics of a Computer

Basics of a Computer – Hardware, Software, Generations of computers. Hardware - functional units, Components of CPU, Memory – hierarchy, types of memory, Input and output devices. Software – systems software, application software, packages, frameworks, IDEs.

Task 1: Demonstrate assembling of computer by detaching and reassembling.

Unit – II Software development

Software development – waterfall model, Agile, Types of computer languages – Programming, markup, scripting Program Development –steps in program development, flowcharts, algorithms, data structures – definition, types of data structures

Task 2: Draw flowchart to find the biggest of three numbers.
Task 3: Write algorithm to find the roots of a quadratic equation.

Unit – III Operating Systems

Operating systems: Functions of operating systems, types of operating systems, Device & Resource management

Database Management Systems: Data models, RDBMS, SQL, Database Transactions, data centers, cloud services

Task 4: Demonstrate the installation of any one operating system.
Task 5: Demonstrate creating a table and insert records with any one dbms application.

Unit – IV Networks

Computer Networks: Advantages of computer networks, LAN, WAN, MAN, internet, WiFi, sensor networks, vehicular networks, 5Gcommunication.

World Wide Web – Basics, role of HTML, CSS, XML, Tools for web designing, Social media, Online social networks.

Security – Information security, Cyber security, Cyber laws.
Task 6: Demonstrate LAN connections and Proxy settings.
Task 7: Create a web page with self data and photo.

Unit – V Autonomous Systems
Autonomous Systems: IoT, Robotics, Drones, Artificial Intelligence – Learning, natural language processing, image and video processing, Game Development, Cloud Basics.
Task 8: Demonstrate any one AI tool to perform tasks.

TEXT BOOK

1. G. Michael Schneider, Invitation to Computer Science, Macalester College, Judith L. Gersting University of Hawaii, Hilo, Contributing author: Keith Miller University of Illinois, Springfield.

REFERENCE BOOKS

1. Reema Thareja, Fundamentals of Computers, Oxford Higher Education, Oxford University Press.
2. Peter Norton, Introduction to computers, 8th Edition, Tata McGraw Hill.
3. Anita Goel, Computer Fundamentals, 2010, Pearson Education India.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
PH107BS	**Applied Physics Laboratory**	0	0	3	1.5

Course Description: This course is designed for the students to provide an opportunity for learning through observation, interpretation and application. It includes the instruments related to the Hall Effect, Photoelectric Effect, dielectric constant and B-H curve experiments and their measurements. It introduces the characteristics of various devices such as P-N junction diode, Zener diode, BJT, LED, solar cell, LASERs and optical fibers, measurement of energy gap and resistivity of semiconductor materials.

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

C107.1: Estimate the work function of metal using Photoelectric effect and identify the type of semiconductor material whether it is n-type or p-type by Hall effect.
C107.2: Determine energy gap and resistivity of semiconductors and draw the characteristics of semiconductor and optoelectronic devices.
C107.3: Understand the electrical and magnetic properties of materials
C107.4: Demonstrate the working principle of lasers and optical fibers

List of Experiments

1. Determination of work function of a metal and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient, carrier concentration and carrier mobility of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE / CB configurations).
6. V-I and L-I characteristics of light emitting diode (LED).
7. V-I Characteristics of solar cell.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Determination of the resistivity of semiconductor by two probe method.
10. Study B-H curve characteristics of a magnetic material.
11. Determination of dielectric constant of a given material.
12. a) Determination of the beam divergence of a given LASER beam.
    b) Determination of acceptance angle and numerical aperture of an optical fiber.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics", 2017, S Chand Publishers.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CS108ES	**Programming for Problem Solving Laboratory**	0	0	2	1

Course Description: This lab introduces the importance of programming, C language constructs, and program development. It introduces standard programming techniques like alternation, iteration and modular programming.

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

CS108.1: Build programs using control structures to solve simple mathematical problems

CS108.2: Apply the concepts of user defined, pre-defined and file handling functions

CS108.3: Develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.

CS108.4: Develop searching and sorting algorithms using C programs

List of Programs

Cycle 1:

Practice session

a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment, bitwise and/or/not, etc.). Read required operand values from standard input.
b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values from standard input.

Simple numeric problems:

a. Write a program for finding the max and min from the three numbers.
b. Write the program for the simple, compound interest
c. Write a program that declares Class awarded for a given percentage of marks, where mark <40% = Failed, 40% to <60% = Second class, 60% to <70% = First class, >= 70% = Distinction. Read percentage from standard input.
d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
   5 x 1 = 5
   5 x 2 = 10
   5 x 3 = 15
e. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
c. Write a program that finds if a given number is a prime number
d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
e. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
g. Write a C program to find the roots of a Quadratic equation.
h. Write a C program to calculate the following, where x is a fractional value. 1-x/2 +x^2/4-x^3/6
i. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+ +x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Cycle 2:

Arrays, Pointers and Functions:

a. Write a C program to find the minimum, maximum and average in an array of integers.
b. Write a function to compute mean, variance, Standard Deviation, sorting of n elements in a single dimension array.
c. Write a C program that uses functions to perform the following:
   (i) Addition of Two Matrices
   (ii) Multiplication of Two Matrices
   (iii)Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.
d. Write C programs that use both recursive and non-recursive functions
   (i) To find the factorial of a given integer.
   (ii) To find the GCD (greatest common divisor) of two given integers. (iii)To find x^n
e. Write a program for reading elements using a pointer into an array and display the values using the array.
f. Write a program for display values reverse order from an array using a pointer.
g. Write a program through a pointer variable to sum of n elements from an array**.**

Files:

a. Write a C program to display the contents of a file to standard output device.
b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

d. Write a C program that does the following: It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function) The program should then read all 10 values and print them back.
e. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Strings:

a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
c. Write a C program that uses functions to perform the following operations:
   To insert a sub-string into a given main string from a given position.
   To delete n Characters from a given position in a given string
d. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
e. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn‘t contain ch.
f. Write a C program to count the lines, words and characters in a given text.

Miscellaneous

a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
b. Write a C program to construct a pyramid of numbers as follows:

```
1          *          1          1                *
1 2        * *        2 3        2 2              * *
1 2 3      * * *      4 5 6      3 3 3            * * *
                                 4 4 4 4          * *
                                                  *
```

Sorting and Searching

a. Write a C program that uses non recursive function to search for a Key value in a given list of integers using linear search method.
b. Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using binary search method.
c. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
d. Write a C program that sorts the given array of integers using selection sort in descending order
e. Write a C program that sorts the given array of integers using insertion sort in ascending order
f. Write a C program that sorts a given array of names

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C, 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, 3rd Edition, Cengage Learning.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, 16th Impression, Pearson
5. Stephen G. Kochan, Programming in C, Fourth Edition, Pearson Education
6. Herbert Schildt, C: The Complete Reference, McGraw-Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EE109ES	**Basic Electrical Engineering Laboratory**	0	0	2	1

Course Description: BEE lab is part of the curriculum for the first year students. The lab is intended for introducing the basic methods and instruments used for measuring the electrical quantities to the newly joined students. The experiments are modeled in such a way that it can be used as a learning aid for the students, as it goes in hand with the theory.

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

C109.1: To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach

C109.2: To Analyze the transient responses of first order circuits.

C109.3: To Evaluate the performance of Transformers through various testing methods.

C109.4: To Evaluate the performance of DC and AC Motors by direct testing methods.

The following experiments are required to be conducted as compulsory.

PART-A

1. Verification of KVL and KCL.
2. Verification of Thevenin's and Norton's theorems.
3. Transient Response of Series RL and RC circuits for DC excitation.
4. Resonance in series RLC circuit.
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer.
7. Performance Characteristics of a DC Shunt Motor.
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

PART-B

1. Verification of Superposition theorem.
2. Three Phase Transformer: Verification of Relationship between Voltages and currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
5. No-Load Characteristics of a Three-phase Alternator.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4

Prerequisite: Mathematical Knowledge at pre-university level

Course Description: The course contains various topics related to Exact differential equations, Orthogonal trajectories, Newton's law of cooling, Natural growth and decay, Second order linear differential equations with constant coefficients and their models, Equations reducible to linear ODE with constant coefficients, Applications to Electric Circuits, Laplace Transforms and their application, Vector point functions and scalar point functions, Vector Differentiation, Vector Integral theorems and their applications.

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

C201.1: Solve first order Ordinary differential equations by analytical methods.
C201.2: Solve higher Ordinary differential equations by analytical methods.
C201.3: Find Laplace and inverse Laplace transform of given functions and solve ODEs by applying Laplace Transform
C201.4: Calculate divergence, curl of a vector point function and gradient of scalar point function.
C201.5: Apply and verify Gauss, Green's & Stoke's theorems and find volume, surface of the solid and work done by force.
C201.6: Evaluate the line, surface & volume integrals and converting them from one to another

Unit – I First Order Ordinary Differential Equations

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

Unit –II Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type eax, sinax, cosax, polynomials in x, $e(x)$, and $xV(x)$, Method of variation of parameters. Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits.

Unit– III Laplace Transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

Unit – IV Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

Unit – V Vector Integration

Line, Surface and Volume Integrals, Vector Integral theorems: Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, 36th Edition, 2010, Khanna Publishers.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5th Editon, 2016, Narosa Publications.

REFERENCE BOOKS

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, 2002, Pearson, Reprint.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, Reprint.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CH202BS	**Engineering Chemistry**	3	1	0	4

Prerequisite: **Fundamental knowledge and solid understanding of chemistry**

Course Description: Engineering Chemistry is a fundamental course designed to provide students with a solid foundation in the principles and applications of chemistry relevant to engineering disciplines. The course aims to equip students with the knowledge and skills necessary to understand the chemical properties of materials, analyze chemical reactions, and apply chemical concepts in engineering practice.

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

C202.1: Analyze the basic properties of water and its usage in domestic and industrial purposes.
C202.2: Inspect the working principles and reaction mechanisms of various energy storage devices
C202.3: Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
C202.4: Impart the fundamental knowledge and sustainability implemented through smart engineering materials.
C202.5: Distinguish various energy sources to prioritise eco-friendly fuels for environmentally sustainable development.
C202.6: Discriminate the limitations of conventional basic engineering materials for developing multiphase materials.

Unit – I Water and its Treatment

Hardness of water – Types of hardness, Units, Estimation of hardness of water by complexometric method; numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by ozonisation and chlorination - breakpoint chlorination. Defluoridation - Determination of F^- ion by ion-selective electrode method. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of Brackish water – Reverse osmosis.

Unit – II Battery Chemistry and Corrosion

Introduction to Electrochemistry- Galvanic Cells, Electrode Potentials, Nernst Equation, EMF of the cell, Cell representation. Classification of batteries- primary, secondary, flow and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air, Pb/$HClO_4$ and Lithium-ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion. Types of corrosion: Galvanic, Water

line and Pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods-Cathodic protection – Sacrificial anode and impressed current methods.

Unit– III Polymeric Materials

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP).

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

Unit – IV Energy Sources

Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – Proximate and Ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages. Hydrogen as fuel-Production, Storage & applications.

Unit – V Engineering Materials

Composites: Introduction- Constituents of composites – advantages, classification and constituents of composites. Applications of composites.

Smart Materials and Engineering Applications: Smart Materials- Classification- (Piezo-electric materials, Shape Memory Alloys, Thermoresponse Materials, Magnetorhetroic Materials, Smart Polymers) SMAs-Nitinol. Thermoresponse materials- Poly vinyl amides.

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS

1. P.C. Jain and M. Jain, Engineering Chemistry, 16th Edition, 2010, Dhanpatrai Publishing.
2. Shashi Chawla, A textbook of Engineering Chemistry, 3rd Edition, 2011, Dhanpatrai and Company (P) Ltd. Delhi.
3. Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, 2nd Edition, 2015, Cambridge University Press, Delhi.
4. B. Rama Devi, P. Aparna, Prasanta Rath, Engineering Chemistry, 1st Edition, 2022, Cengage Publications.

REFERENCE BOOKS

1. H.D.Gesser, Applied Chemistry: A Textbook for Engineers and Technologists, 1st Edition, 2002, Springer New York.
2. Jaya Shree Anireddy, Textbook of Engineering Chemistry, 1st Edition, 2018, Wiley.
3. M. Thirumala Chary, E. Laxminarayana, Engineering Chemistry, 3rd Edition, 2016, Scitech Publishers.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
ME203ES	**Computer Aided Engineering Graphics**	1	0	4	3

Course Description: To acquire computer-aided drafting skill set and to build the ability to visualize various objects through traditional drawing practice in order to communicate concepts and ideas in the design of engineering products.

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

C203.1: Construct different types of non-circular curves and scales used in various engineering applications.
C203.2: Analyze the projections of points and lines.
C203.3: Analyze the projections of planes and solids.
C203.4: Apply different types of sectional planes to get the interior features of the objects by means of sectional views.
C203.5: Develop the surfaces to fabricate the objects
C203.6: Identify orthographic, Isometric projections and various CAD commands.

Unit – I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Geometrical Constructions.
Scales: Plain & diagonal.
Conic Sections: Conic Sections including the rectangular hyperbola- General methods only.
Cycloidal curves: Cycloid, Epicycloid and Hypocycloid -General methods only.

Unit – II

Orthographic Projections: Principles of orthographic projections-conventions-Projections of points in all positions.
Projection of straight lines: Line inclined to one reference plane and with two reference lanes.

Unit – III

Projections of Planes: Projections of Plane geometric figures
Projections of Regular Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simple position and axis inclined to one reference plane and with two reference plane **Introduction to computer aided drafting:** (For internal evaluation weightage only)
Introduction to AutoCAD Software: The Menu System, Toolbars (Standard, Object Properties, Draw)

Unit – IV

Section of Regular solids: Section or Sectional views of Right Regular Solids- Prism, Cylinder, Pyramid and Cone. Development of Surfaces of Right Regular Solids

Unit – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale Isometric Views – Isometric views of Lines, Planes and Simple Solids only. Orthographic Views: Conversion of Isometric Views to Orthographic Views and Vice-Versa.

Auto CAD Software: (For internal evaluation weightage only)

Toolbars (Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

TEXT BOOKS

1. Bhatt, N. D., V. M. Panchal, and Pramod R. Ingle, Engineering Drawing, Fifty Third edition, 2016, Charotar Publishing House Pvt. Limited.
2. Agrawal, Basant, and C. M. Agrawal, Engineering Drawing, Third Edition, 2020, Tata McGraw Hill Education (India).
3. Venugopal, K., Sreekanjana, G.,Engineering Drawing, Second Edition, 2011, New Age International.
4. Jeyapoovan, T., Engineering drawing & Graphics Using AutoCAD, Third Edition, 2010, Vikas Publishing House.

REFERENCE BOOKS

1. Parthasarathy, N. S., and Vela Murali, Engineering drawing, First Edition, 2015, Oxford University Press.
2. Balaveera Reddy, K., Computer Aided Engineering Drawing, Second Edition, 2015, CBS Pvt. Limited.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EC204ES	**Electronic Devices and Circuits**	2	0	0	2

Course Description: This course provides an in-depth understanding of the principles, operation, and design of electronic devices and circuits, equipping students with the knowledge and skills necessary to analyze, design, and troubleshoot electronic systems.

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

C204.1: Analyze the characteristics of PN junction diode.
C204.2: Construct diode circuits for various applications.
C204.3: Illustrate the transistor working in different configurations.
C204.4: Differentiate between FET and BJT devices.
C204.5: Illustrate the operation and characteristics of special purpose diodes.
C204.6: Use diode and transistor as switches in electronic circuits.

Unit – I Diodes

Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times

Unit – II Diode Applications

Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

Unit – III Bipolar Junction Transistor (BJT)

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times.

Unit – IV Junction Field Effect Transistor (FET)

Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

Unit – V Special Purpose Devices

Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Schottky diode.

TEXT BOOKS

1. Jacob Millman - Electronic Devices and Circuits, McGraw Hill Education.
2. Robert L. Boylestad, Louis Nashelsky- Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

REFERENCE BOOKS

1. David A. Bell - Electronic Devices and Circuits, 5th Edition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly - Basic Electronics-Principles and Applications, Cambridge, 2018.
3. Thomas L. Floyd - Electronic Devices, 9th Edition, 2012, Pearson.
4. A. Anand Kumar - Pulse and Digital Circuits - PHI Learning.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EN205HS	**English for Skill Enhancement**	2	0	0	2

Course Description: With the growing importance of English as a tool for global technical communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop the linguistic, communicative, creative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development.

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

C205.1: Apply English language effectively in spoken and written forms
C205.2: Analyze the given texts and essence of poem, respond appropriately
C205.3: Apply various grammatical structures in personal and academic fronts.
C205.4: Develop appropriate vocabulary for professional communication
C205.5: Make use of competency in various forms of academic and professional writing.
C205.6: Improve language skills for the enhancement of employability opportunities.

Unit – I Toasted English by R. K. Narayan

Vocabulary: The concept of Word Formation, Prefixes and Suffixes
Grammar: Identifying Common Errors in Writing with Reference to Articles and prepositions
Reading Skills: Reading and Its Importance- Techniques for Effective Reading.
Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents**.**

Unit – II Appro JRD by Sudha Murty

Vocabulary: Words Often Confused, Homophones, Homonyms and Homographs & collocations
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun and Subject-verb Agreement.
Reading Skills: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice
Writing Skills: Nature and Style of Writing

Unit – III The Character of a Happy Life by **Sir Henry Wotton (Poem) Vocabulary**: Words Often Misspelt, - Words from Foreign Languages and their Use in English **Grammar**: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses
Reading Skills: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.
Writing Skills: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

Unit – IV Art and Literature by Abdul Kalam

Vocabulary: Standard Abbreviations in English.
Grammar: Redundancies and Clichés in Oral and Written Communication
Reading Skills: Reading Techniques- Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing Skills: Writing Practices- Essay Writing-Writing Introduction, Body and conclusion

Unit – V Go, Kiss the World by Subroto Bagchi Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading Skills: Reading Comprehension-Exercises for Practice
Writing Skills: Technical Reports- Introduction – Characteristics of a Report – Categories of Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

TEXT BOOK

1. English: Language, Context and Culture by Orient Black Swan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS

1. Liss and Davis, Effective Academic Writing, 2nd Edition, 2017, Oxford University Press.
2. Wood,F.T, Remedial English Grammar , 2017, 2nd Edition, Macmillan.
3. Wiley, Technical Communication, 2019, India Pvt. Ltd.
4. Swan, Michael. Practical English Usage, 4th Edition, 2016, Oxford University Press.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CS206ES	**Python Programming Laboratory**	0	1	2	2

Course Description: This Course Covers Installation procedure of python and packages. Course focuses on implementation of different control structures, data structures and Files in Python. It also helps to implement GUI applications using TKinter.

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

C206.1: Build basic programs using fundamental programming constructs.
C206.2: Explore Strings, Lists, Tuples and Dictionaries in Python
C206.3: Develop reusable code and GUI application using standard Library.
C206.4: Implement File I/O and Digital Logic Gates using Python

List of Programs

CYCLE 1:

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii) Start the Python interpreter and type help to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. i) Write a program to calculate compound interest when principal, rate and number of periods are given.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

5. Find the Euclidean distance with the given values and check the validity of values to find the distance.
6. Generate a random number between 1-10 and ask the user to guess the number. Give chance for 3 times. If guessed correctly then congratulate otherwise print message as sorry.
7. Accept a string and generate the combinations of string until the source string doesn't get repeated.
8. Generate prime numbers of fibonacci series between 1-50.

Week - 3:

9. i) Write a program to convert a list and tuple into arrays.
   ii) Write a program to find common values between two arrays.
10. Write a program to add comma separators in a given big number as per the standard American convention. Ex: i/p: 100000000 o/p: 100,000,000
11. Write a program to convert given formula 3X+4Y as 3*X+4*Y and 3(X+Y) as 3*X+3*Y

Week - 4:

12. Write a function called is sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
13. Write a function called has duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
    i) Write a function called remove duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
    ii) The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
    iii) Write a python code to read dictionary values from the user. Construct a function to Invert its content. i.e., keys should be values and values should be keys.
14. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
    ii) Remove the given word in all the places in a string?
    iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper-case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
15. Write a recursive function that generates all binary strings of n-bit length

Week - 5:

16. i) Write a python program that defines a matrix and prints
    ii) Write a python program to perform addition of two square matrices
    iii) Write a python program to perform multiplication of two square matrices
17. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
18. Use the structure of exception handling all general purpose exceptions.

CYCLE 2:

Week-6:

19. i) Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
    ii) Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color.

iii) Write a function called draw point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

iv) Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw circles on the canvas.

20. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.

21. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7:

22. Write a Python code to merge two given file contents into a third file.
23. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
24. Write a Python code to Read text from a text file, find the word with most number of occurrences
25. Write a function that reads a file file1 and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

26. Import numpy, Plotpy and Scipy and explore their functionalities.
    a) Install NumPy package with pip and explore it.
27. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
28. Write a program to implement Half Adder, Full Adder, and Parallel Adder
29. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS

1. Brian R. Overland and John Bennett, Supercharged Python: Take your code to the next level, O'Reilly.
2. Mark Lutz, Learning Python, O'Reilly.

REFERENCE BOOKS

1. Dr. Mohd. Abdul Hameed, Python for Data Science, Wiley Publications - 1st Ed. 2021.
2. Vamsi Kurama, Python Programming: A Modern Approach, Pearson.
3. Sheetal Taneja, Naveen Kumar, Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Pearson.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CH207BS	**Engineering Chemistry Laboratory**	0	0	2	1

Prerequisite: Fundamental knowledge of quantitative and qualitative analysis

Course Description: The Engineering Chemistry Laboratory is a practical course designed to provide students with hands-on experience in conducting chemical experiments relevant to engineering applications. This laboratory-based course aims to reinforce the theoretical concepts learned in the engineering chemistry lecture course and develop students' practical skills in chemical analysis, synthesis, and material testing.

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

C207.1: Analysis of materials using small quantities of materials involved for quick and accurate results

C207.2: Interpret a new application by the analysis of physical principle involved in various instruments.

C207.3: Develop experimental skills in building technological advances by qualitative and quantitative analysis of materials.

C207.4: Learn and apply basic techniques used in chemistry laboratory for preparation, purification and identification.

List of Experiments

1. Determination of total hardness of water by complexometric method using DTA.
2. Estimation of concentration of an acid by Conductometric titrations.
3. Estimation of concentration of an acid by pH metry.
4. Estimation of Concentration of Ferrous Iron (II) by Potentiometry using $KMnO_4$.
5. Estimation of Concentration of Fluoride ion by UV-Visible spectrometer.
6. Determination of viscosity of lubricant oil by using Ostwald’s viscometer.
7. Preparation of Bakelite.
8. Determination of rate of corrosion of mild steel in presence and absence of inhibitor.
9. Determination of Acid value of given coconut oil.
10. Proximate analysis of solid fuel- Coal.

Virtual Lab Experiments

1. Batteries for Electric Vehicles.
2. Conducting Polymers-Study and Working.
3. Smart Materials-Engineering Applications.
4. Construction of Fuel Cell & It’s Working.

TEXT BOOKS

1. J. Mendhem, RC. Denney, JD Barnes, M . Thomas, B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, 2009, Pearson publishing.
2. S.S. Dhara, A Textbook on Experiments and Calculations in Engineering Chemistry, 9th Edition, 2015, S. Chand.
3. B. Ramadevi, P. Aparna, Laboratory Manual in Engineering Chemistry, Special Edition, 2022, S. Chand Publishing.
4. K. Mukkanti, Practical Engineering Chemistry, 1st Edition, 2009, BS Publications.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EN208HS	**English Language and Communication Skills Laboratory**	0	0	2	1

Course Description: The course aims an in-depth look into English articulation and its sound system, thus developing your sensitivity to all aspects of English pronunciation. Students develop their listening skills to appreciate its role in the LSRW skills approach to language and improve their pronunciation. Students able to express themselves fluently and appropriately in social and professional contexts.

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

C208.1: Understand the nuances of English language through audio – visual experience
C208.2: Apply soft skills effectively while working in group activities
C208.3: Create Neutralize accent for intelligibility
C208.4: Understand and Discuss with clarity and confidence which in turn enhances their employability skills

Listening Skills

Objectives

1. To enable students develop their listening skills to appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts.

- Oral practice: Just A Minute (JAM) Sessions
- Describing objects/situations/people
- Role play – Individual/Group activities
- Group Discussions
- Debate

Exerise-1

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

Practice: Introduction to Phonetics–Speech Sounds–Vowels and Consonants–Minimal Pairs-Consonant Clusters-Past Tense Marker and Plural Marker-Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session - Situational Dialogues–Greetings–Taking Leave – Introducing Oneself and Others.

Exercise II

CALL Lab:

Understand: Structure of Syllables –Word Stress–Weak Forms and Strong Forms–Stress pattern in sentences– Intonation.

Practice: Basic Rules of Word Accent– Contractions –Stress Shift-Weak Forms and Strong Forms – Intonation in context -Testing Exercises

ICS Lab:

Understand: Features of Good Conversation–Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play-Expressions in Various Situations Making Requests and Seeking Permission-Telephone Etiquette

Exercise-III

CALL Lab:

Understand: Errors in Pronunciation-Neutralizing Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation–Differences between British and American Pronunciation-Testing Exercises

ICS Lab:

Understand: Descriptions-Narrations-Giving Directions and Guidelines–Blog Writing- Netiquette

Practice: Giving Instructions–Seeking Clarifications–Asking for and Giving Directions – Thanking and Responding in a forum–Agreeing and Disagreeing–Seeking and Giving Advice –Making Suggestions.

Exercise-IV

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests-Testing Exercises

ICS Lab:

Understand: Public Speaking–Structured Talks - signposting in speech-Non-verbal Communication-Presentation Skills.

Practice: Making a Short Speech – Extempore-Making a Presentation

Exercise-V

CALL Lab:

Understand: Listening for Inference (focus on implicit meaning)

Practice: Listening Comprehension Tests-Testing Exercises

ICS Lab:

Understand: Introduction to Group Discussion & Interview Skills

Practice: Group Discussion & Mock Interviews

Minimum Requirement of Infrastructural Facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder, etc.

Source of Material (Master Copy):

- Exercises in Spoken English. Part1, 2, 3. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

SUGGESTED SOFTWARE

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS

1. Y. Prabhavathi, People Interface: English Language Communication Skills Manual/Workbook, 1st Edition, 2023, CL India.
2. Board of Editors, ELCS Lab Manual A Workbook for CALL and ICS Lab Activities Orient Black Swan Pvt. Ltd.
3. Shobha, KN & Rayen, J. Lourdes Communicative English–A work book, 2019, Cambridge University Press.

B. Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
CS209ES	IT Workshop	0	0	2	1

Prerequisite **Elements of Computer Science and Engineering.**

Course Description: This Lab course describes various OS installation procedures. It enables the student to get hands on with various Productivity tools including Word, Excel, PowerPoint and Latex. It introduces the concepts of the Internet & World Wide Web.

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

C209.1: Demonstrate the step-by-step installation process of the Operating System.

C209.2: Evaluate the credibility and reliability of online sources found through search engines.

C209.3: Use productivity tools like Word processors, PowerPoint and Latex to perform various tasks.

C209.4: Apply the knowledge of Excel functions for performing calculations and plotting to represent the input data.

List of Programs

Cycle:1

PC Hardware

Task 1: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 2: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task 1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Cycle: 2
LaTeX and WORD

Task 1: **Word Orientation:** The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
Task 2: Using LaTeX and Word to create a Project Certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.
Task 3: Using LaTeX and Word Creating Project Abstract. Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Cycle: 3
Excel Orientation
The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel – average, std. deviation, Count function, Renaming and Inserting worksheets, Hyper linking

Task 2: Formatting - Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

Task 3: Data consolidation and validation - Charts, Calculating GPA, LOOKUP / VLOOKUP, Pivot Table

PowerPoint & Presentation using Latex
Task 1: Students will be working on basic power point utilities and tools which help them create basic PowerPoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.
Task 2: Interactive presentations - Hyperlinks, Inserting – Images, ClipArt, Audio, Video, Objects, Tables and Charts.
Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation,

slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

Task 4: Create a Presentation: Features to be covered:-Templates, Slide Transitions, and Customization Options, Image formats and provides options for Resizing, Positioning, and Captioning images, hyperlink and Animations and Multimedia elements such as Videos and Audio clips, enabling you to create dynamic and interactive presentations on Real Time Scenario.

REFERENCE BOOKS

1. Vikas Gupta, Comdex Information Technology course tool kit, WILEY Dreamtech.
2. Cheryl A Schmidt, The Complete Computer upgrade and repair book, 3rd edition, WILEY Dreamtech.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Kate J. Chase, PC Hardware - A Handbook –PHI (Microsoft).
5. Leslie Lamport LaTeX Companion, PHI/Pearson.
6. David Anfinson and Ken Quamme, IT Essentials PC Hardware and Software Companion Guide, Third Edition, CISCO Press, Pearson Education.
7. Patrick Regan–IT Essentials PC Hardware and Software Labs and Study Guide Third Edition, CISCO Press, Pearson Education.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
IT301PC	**Digital Electronics**	3	0	0	3

Course Description: This course provides thorough understanding of basic concepts required for digital system design.

Course Outcomes: After completion of this course, the students will be able tos

C301.1: Apply the concepts of number systems, and codes in digital system design
C301.2: Minimize Boolean expression using various techniques
C301.3: Design combinational logic circuits for given specifications
C301.4: Design Shift Registers and Counters using flip-flops
C301.5: Implement logic functions using PLDs and Illustrate the functionality of various memories.
C301.6: Design and optimize asynchronous sequential circuits

Unit – I Boolean Algebra and Logic gates

Digital Systems, Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes, Binary Storage and Registers, Binary logic.

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.

Unit – II Gate-Level Minimization

The map method, Four-variable map, Five-Variable map, product of sums simplification Don't-care conditions, NAND and NOR implementation other Two-level implementations, Exclusive – OR function.

Unit – III Combinational Logic

Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers.

Unit – IV Sequential Logic

Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure**.** Registers, shift Registers, Ripple counters, synchronous counters, other counters.

Unit – V Memories and Asynchronous Sequential Logic

Introduction, Random-Access Memory, Memory Decoding, Error Detection and correction Read-only memory, Programmable logic Array programmable Array logic, Sequential Programmable Devices.

Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Reduction of state and Flow Tables, Race-Free state Assignment Hazards, Design Example.

TEXT BOOKS

1. M. Morris Mano, Digital Design, Third Edition, Pearson Education.
2. Albert Paul Malvino Donald P. Leach, Digital Principles and Applications, Tata McGraw Hill Edition.
3. Roth, Fundamentals of Logic Design, 5th Edition, Thomson.

REFERENCE BOOKS

1. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill.
2. C.V.S. Rao, Switching and Logic Design, Pearson Education.
3. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill.
4. M. Rafiquzzaman, Fundamentals of Digital Logic and Microcomputer Design, 5th Edition, John Wiley.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS302PC	**Data Structures**	3	0	0	3

Prerequisite: **Programming for Problem Solving**

Course Description: This course covers linear data structures such as stack, queue and linked lists. Discuss various operations on non-linear data structures like trees and graphs. Introduces various sorting techniques and pattern matching algorithms.

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

C302.1: Implement various operations on linear data structures to solve real world problems.
C302.2: Design solutions using Dictionaries, Hash Tables and time complexity.
C302.3: Implement various kinds of trees and its operations.
C302.4: Describe graph representations and implement traversals.
C302.5: Implement various sorting algorithms.
C302.6: Demonstrate the Pattern matching algorithms and Tries.

Unit – I Introduction to Data Structures

Introduction to Data Structures: abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

Unit – II Dictionaries, Hash Tables and Complexity

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching.

Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

Introduction to complexity: The Growth of Functions, asymptotic notations.

Unit – III Search Trees

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, B- Trees, B+ Trees, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees.

Unit – IV Graphs & Sorting

Graphs: Graph Implementation Methods. Graph Traversal Methods.

Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

Unit – V Pattern Matching and Tries

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

TEXT BOOKS

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. A. S. Tanenbaum, Y. Langsam, and M.J. Augenste, Data Structures using C, PHI/Pearson Education.

REFERENCE BOOK

1. R. F. Gilberg and B.A. Forouzan Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS303PC	**Discrete Mathematics**	3	0	0	3

Course Description: Discrete mathematics is the study of mathematical structures that are discrete, separated, or distinct. The course covers formal logic notation, inference mechanisms, sets, functions, relations, algebraic structures, permutations and combinations, counting principles, elementary graph theory.

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

C303.1: Read, comprehend, and construct mathematical arguments for proofs.
C303.2: Model real-world problems using graphs and trees.
C303.3: Work and Apply Discrete Structures.
C303.4: Apply combinations and permutations to various problems.
C303.5: Solve problems using Binomial and Multinomial Theorems.
C303.6: Ability to analyze and solve counting problems on finite and discrete structures

Unit – I Mathematical logic

Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus

Unit – II Graph Theory

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

Unit – III Set theory

Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions, Partial ordering.

Unit – IV Elementary Combinatorics

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

Unit –V Advanced Counting Techniques

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion- Exclusion, Applications of Inclusion-Exclusion.

TEXT BOOKS

1. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, 1st Editon, McGraw-Hill.
2. Joe l. Mott, Abraham Kandel, Teodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Prentis Hall of India.

REFERENCE BOOKS

1. Ralph.P. Grimald, Discrete and Combinatorial Mathematics - an applied introduction, 5th Edition Pearson Education,.
2. Thomas Kosy, Discrete Mathematical Structures, Tata McGraw Hill publishing co.
3. Kenneth H Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7 th Edition, TMH.
4. Richard Johnsonbaugh, Discrete Mathematics, 7 th Edition., Pearson Education.
5. Edgar G. Goodaire, Michael M. Parmenter, Discrete Mathematics with Graph Theory.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS304PC	**Database Management Systems**	3	0	0	3

Course Description: The course focuses on database management systems, its architecture, and various applications. This course contains the topics related to conceptual data modelling, relational data model, relational query languages, relational database design and transaction management and files. The course also focuses on the fundamentals of knowledgebase and relational database management systems, and the current developments in database theory and the practice.

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

C304.1: Understand the basic concepts of DBMS
C304.2: Design conceptual models using ER Diagram and normalize the model
C304.3: Impose constraints on relations
C304.4: Implement the procedural and non-procedural languages on database
C304.5: Understand the recovery and concurrency control techniques
C304.6: Describe file organization techniques and tree-based indexing structures.

Unit – I Database Management Systems, Database Design and ER Model

Introduction to Database Management Systems: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS.

Database Design and ER Model: Entities, Attributes, Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Database Design and ER Diagrams, Conceptual Design with the ER Model.

Unit – II Schema Refinement and Relational Model

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form.

Relational Model: Introduction to Relational Model, Constraints on the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design.

Unit – III Formal Query Languages and SQL

Formal Relational Query Languages: Relational Algebra, Relational Calculus - Tuple relational Calculus, Domain relational calculus.

Structured Query Language: Form of basic SQL query, DDL Commands, DML Commands, UNION, INTERSECT and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, Introduction to views, destroying/altering tables and views, triggers, and active databases.

Unit – IV Transaction Management

Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation-Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

Unit – V File Organization

File Organization: Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes-Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+Trees: A Dynamic Index Structure.

TEXT BOOKS

1. Silberschatz, Korth, Database System Concepts, V edition, 3rd Edition, McGraw Hill.
2. Raghurama Krishnan, Johannes Gehrke Database Management Systems, Tata McGraw Hill.

REFERENCE BOOKS

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Corone l7th Edition.
2. Elmasri Navrate, Fundamentals of Database Systems, Pearson Education.
3. C.J.Date, Introduction to Database Systems, Pearson Education.
4. The XTeam, S.Shah and V.Shah, SPD Oracle for Professionals.
5. Shah, Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, PHI.
6. M.L. Gillenso**,** Fundamentals of Database Management Systems.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
IT305PC	**Introduction to IoT**	2	0	0	2

Course Description: This course focuses on basic concepts of IoT, programming using Arduino and Raspberry Pi boards. It describes protocol stacks, data handling and analytics, cloud-based IoT service platform to execute tasks that are commonly encountered in industrial settings.

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

C305.1: Understand key characteristics, layers, protocols, sensor networks and their role in IoT.
C305.2: Differentiate between IoT and M2M communications and achieve interoperability using Arduino Programming.
C305.3: Apply Python constructs on Raspberry Pi interfacing models and their use cases.
C305.4: Design and implement SDN-based solutions for IoT deployments using Rasberry Pi
C305.5: Apply the knowledge of cloud storage models to select an appropriate model for any IoT application.
C305.6: Analyze different sensor technologies for real world applications through IoT.

Unit – I Introduction to IoT and Sensor Networks
Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

Unit – II Machine to Machine- Arduino Programming for IoT
Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors, and Actuators with Arduino.

Unit – III Raspberry Pi with Python Programming
Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi, Case studies.

Unit – IV Software Defined Network for IoT
Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

Unit – V Cloud Storage models with Use Cases
Introduction to Cloud Storage Models, Web server for IoT, Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT. Case Study: Agriculture, Healthcare, Activity Monitoring.

TEXT BOOKS

1. Pethuru Raj and Anupama C. Raman "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”.

REFERENCE BOOKS

1. Terokarvinen, kemo, karvinen and villeyvaltokari, “Make sensors”: 1st edition, 2014, Maker media.
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice.
3. Charles Bell, Beginning Sensor networks with Arduino and Raspberry Pi, 2013, Apress.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS306PC	**Data Structures Lab**	0	0	3	1.5

Course Description: This course focuses on implementation of linear data structures and sorting algorithms. Course also deals operations related to different height balanced trees, graph traversing and pattern matching algorithms.

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

C306.1: Implement with various kinds of linked list and their operations
C306.2: Design programs to implement stack and queue ADT
C306.3: Implement programs for sorting algorithms
C306.4: Implement trees and graph traversal and pattern matching algorithms

List of Programs

Cycle 1:

1. Write a program that uses functions to perform the following operations on singly linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly Linked List :i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular Linked List : i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implements stack (its operations) using i) Arrays ii) Pointers
5. Write a program that implements Queue (its operations) using i) Arrays ii) Pointers
6. Write a program that implements hashing

Cycle 2:

7. Write a program that implements the following sorting methods to sort a given list of integers in ascending order i) Quick sort ii) Heap sort iii) Merge sort
8. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).
9. Write a program to implement i) Binary Search tree ii) B-Trees iii) B+ Trees iv) AVL Trees v) Red - Black trees
10. Write a program to implement the graph traversal methods.
11. Implement a Pattern matching algorithm using Boyer- Moore, Knuth-Morris-Pratt

TEXT BOOKS

1. E. Horowitz, S. Sahni and Susan Anderson, Freed Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures using C, PHI/ Pearson Education.

REFERENCE BOOK

1. R. F. Gilberg and B. A.Forouzan Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
IT307PC	**Digital Electronics Laboratory**	0	0	2	1

Course Description: This course describes about realization and implementation of Boolean functions. Also design and verification of various combinational and sequential circuits.

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

C307.1: Realize Boolean functions using gates
C307.2: Implement Boolean functions using combinational building blocks
C307.3: Design and verify various combinational circuits
C307.4: Design and verify various sequential circuits

List of Experiments:

1. Realization of Logic circuit to generate r's Complement using Logic Gates.
2. Realization of given Boolean function using universal gates and minimizing the same. Compare the gate count before and after minimization.
3. Design and realize Full Adder circuit using gates/universal gates. Implement Full Subtractor using full adder.
4. Designing a 2 – bit Comparator using AND, OR and NOT gates. Realize 4 – bit Comparator using 2 – bit Comparators.
5. Realize 2:1 MUX using the given gates and Design 8:1 using 2:1 MUX.
6. Implement the given Boolean function using the given MUX (ex: code converters).
7. Realize a 2x4 Decoder using logic gates and implement 3x8 Decoder using 2x4 Decoder.
8. Implement the given Boolean function using given Decoders.
9. Convert Demultiplexer to Decoder and vice versa.
10. Verification of truth tables of flip flops using different clocks (level triggering, positive and negative edge triggering) also converts the given flip flop from one type to another.
11. Designing of Universal n-bit shift register using flip flops and Multiplexers. Draw the timing diagram of the Shift Register.
12. Design a Synchronous binary counter using D-flipflop /given flip flop.
13. Design Asynchronous counter for the given sequence using given flip flops.
14. Designing of MOD 8 Counter using JK flip flops.

Note: Minimum of 12 Experiments are to be performed

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS308PC	**Database Management Systems Lab**	0	0	2	1

Course Description: This course aims to provide a deep understanding of concept design, modelling, and practical implementation of databases. Course explores the proficiency in writing and executing Data Definition Language (DDL), Data Manipulation Language (DML) commands, querying, subqueries, aggregate functions, normalization, triggers, procedures, and cursors.

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

C308.1: Create conceptual design for the real world problems using ER Diagrams.
C308.2: Convert the conceptual model into relational and normalize.
C308.3: Apply DDL and DML commands on given database
C308.4: Implement Triggers, Procedures and Cursors.

List of Experiments:

Cycle 1:

1. Concept design with E-R Model.
2. Relational Model.
3. Normalization.
4. Practicing DDL commands.
5. Practicing DML commands.

Cycle 2:

6. a. Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)
   b. Nested, Correlated sub queries
7. Queries using Aggregate functions, GROUPBY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger)
9. Procedures.
10. Usage of Cursors.

TEXT BOOKS

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, Tata McGraw-Hill.
2. Silberschatz, Korth, Database System Concepts, V Edition, McGraw-Hill.

REFERENCE BOOKS

1. Peter Rob Carlos Corone, Database Systems design, Implementation, and Management, l7th Edition.
2. Elmasri Navrate, Fundamentals of Database Systems, Pearson Education.
3. C.J. Date, Introduction to Database Systems, Pearson Education.
4. S. Shah and V. Shah, SPD Oracle for Professionals, The X Team.
5. Shah, Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, PHI.
6. M.L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.
7. Fundamentals of Database Management Systems, M.L. Gillenson, Wiley Student Edition.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
CS309PC	**Data Visualization – R Programming / Power BI**	0	0	2	1

Course Description: This lab course contains topics related to effective use of Business Intelligence technology and to apply data visualization. It helps to discern patterns and relationships in the data, build dashboard applications, and communicate the results clearly and concisely.

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

C309.1: Understand how to import data into Tableau.
C309.2: Understand Tableau concepts of Dimensions and Measures.
C309.3: Develop Programs and understand how to map Visual Layouts and Graphical Properties
C309.4: Create Dashboard, custom charts, and, publish to tableau online for any real-time dataset

List of Programs

Cycle 1:

1. Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.
3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data
6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.

Cycle 2:

7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8. Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, sharing your visualizations, Printing and exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.
11. Visualize various data patterns taking any dataset from Kaggle.

REFERENCE BOOKS

1. Brett Powell, Microsoft Power BI cookbook, 2nd Edition.
2. Roger D. Peng, R Programming for Data Science.
3. Norman Matloff Cengage Learning India, The Art of R Programming.

B. Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
IT310PC	**Internet of Things Lab**	0	0	3	1.5

Course Description: This course is designed to provide students with practical knowledge and hands- on experience in the field of Internet of Things (IoT). The course explores the fundamental concepts, technologies, and applications of IoT, enabling students to understand the interconnectivity of physical devices and their integration with the digital world.

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

C310.1: Illustrate various IoT devices, sensors, and actuators, including Arduino, Raspberry Pi, and microcontrollers.
C310.2: Identify sensors technologies used in IoT applications and their working principles.
C310.3: Apply programming languages like Python, C/C++ in IoT applications.
C310.4: Develop skills in collecting data from sensors and processing it using microcontrollers or edge computing devices.

List of Experiments

Cycle 1:

1. Installing OS on Raspberry Pi
   a. Installation using Pi Imager
   b. Installation using image file
      - Downloading an Image
      - Writing the image to an SD card using Linux using Windows
      - Booting up Follow the instructions given in the URL https://www.raspberrypi.com/documentation/computers/getting-started.html

2. Accessing GPIO pins using Python
   a. Installing GPIO Zero library.
      First, update your repositories list:
      sudo apt update
      Then install the package for Python 3:
      sudo apt install python3-gpiozero
   b. Blinking an LED connected to one of the GPIO pin
   c. Adjusting the brightness of an LED Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

3. Using Raspberry Pi
   a. Calculate the distance using a distance sensor.
   b. Basic LED functionality using switch.

4. Using Arduino
   a. Calculate the distance using a distance sensor.
   b. Basic LED functionality using switch.
   c. Calculate temperature using a temperature sensor.

Cycle 2:

5. Using Node MCU
    a. Including required libraries of Node MCU
    b. Calculate the distance using a distance sensor.
    c. Basic LED functionality using switch.
    d. Calculate temperature using a tempe rature sensor

6. Using ESP32
    a. Including required libraries of ESP32.
    b. Calculate the distance using a distance sensor.
    c. Basic LED functionality using switch.
    d. Calculate temperature using a temperature sensor.

7. Collecting Sensor Data
    a) DHT Sensor interface
        - Connect the terminals of DHT GPIO pins of Raspberry Pi.
        - Import the DHT library using import Adafruit, DHT.
        - Read sensor data and display it on screen.
        - Read sensor data and display it on the Cloud platform using Thing Speak (API).
        - Read sensor data and display it through the Blynk App.

TEXT BOOKS

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, 2015, Universities Press.
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, 2014, O'Reilly.

REFERENCE BOOKS

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
MC311	**Environmental Science**	3	0	0	0

Course Description: This course enables the students engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems. It provides the scope to examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings out an appreciation of our natural world and human impact on its existence and integrity. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health, Anthropology, Economics, Statistics, Computers and Philosophy.

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

C311.1: Analyze the important components of environment.
C311.2: Illustrate the major environmental effects of exploiting natural resources.
C311.3: Utilize environmental laws for the protection of forest and wildlife.
C311.4: Categorize different types of pollutions and their control measures and discover effective methods of waste management.
C311.5: Identify global environmental problems and come out with best possible solutions.
C311.6: Illustrate green environmental issues.

Unit – I Ecosystems

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnifications, ecosystem value, services and carrying capacity, Field visits.

Unit – II Natural Resources: Classification of Resources

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

Unit – III Biodiversity and Biotic Resources

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity, consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wild life conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation.

Unit – IV Environmental Pollution and Control Technologies: Environmental Pollution

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Waste water Treatment methods: Primary, secondary and Tertiary.

International conventions /Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. **Green Environmental Issues:** Clean development mechanism, carbon foot printing, carbon credits, carbon sequestration and Polluter pay principle

Unit – V Environmental Policy, Legislation & EIA

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wildlife Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of base line data acquisition. Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses.1st edition, 2005, Universities press.
2. Anubha Kaushik, C.P. Kaushik, Perspectives in Environmental Studies, 4th edition, 2014, New age international publishers.
3. S. Deswal and A. Deswal, A basic course in environmental studies, 2nd edition, 2004, Dhanapathi rai & Co.
4. Benny Joseph, Environmental studies, 3rd edition, 2017, McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS

1. Daniel B. Botkin and Edwards A. Keller, Environmental science, 8th edition, 2010, Wiley India (P) Ltd.
2. Richard T. Wright, Environmental Science: towards a sustainable future, 4th edition, 2008, PHL Learning Private Ltd.
3. P.D. Sharma, Ecology and Environment, 5th edition, 2009, Rastogi Publications.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
IT401PC	**Computer Organization & Microprocessor**	3	0	0	3

Course Description: The course contains various components of the computer organization and the Assembly Language Programming with 8086. The course also covers Parallel Processing concepts**.**

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

C401.1: Understand the basic components of CPU, ALU and Control Unit.
C401.2: Make use of the instruction set, instruction formats and addressing modes of 8086.
C401.3: Develop assembly language programs to solve problems.
C401.4: Design Hardware and Algorithms for manipulation of data, represented in different formats.
C401.5: Implement data transfer with appropriate I/O Interface and Interrupt mechanism.
C401.6: Choose suitable type of memory and suitable mechanism for Parallel Processing.

Unit – I Basic Computer Organization and Microprogrammed control

Digital Computers: Definition of Computer Organization, Computer Design and Computer Architecture. Types of architecture – Von Neumann and Harvard.

Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Unit – II Central Programming Unit and 8086 Microprocessor

Central Processing Unit: The 8086 Processor Architecture, Register organization, Physical memory organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum and Maximum mode system and timings.

8086 Instruction Set and Assembler Directives-Machine language instruction formats, Addressing modes, Instruction set of 8086, Assembler directives and operators.

Unit – III Assembly Language Programming with 8086

Assembly Language Programming with 8086- Machine level programs, Machine coding the programs, Programming with an assembler, Assembly Language example programs.

Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Interrupt programming, Passing parameters to procedures, Macros, Timings and Delays.

Unit – IV Computer Arithmetic and Input/Output Organization

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating - point Arithmetic operations.

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

Unit – V Computer Memory Organization and Pipeline/Vector Processing

Memory Organization: Main Memory, Associate Memory, Cache Memory.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

TEXT BOOKS

1. M. Moris Mano, "Computer System Architecture", Third Edition, Pearson.
2. K M Bhurchandi, A.K Ray, "Advanced Microprocessors and Peripherals", 3rd Edition, McGraw-Hill India Education Private Ltd.

REFERENCE BOOKS

1. D V Hall, SSSP Rao, "Microprocessors and Interfacing", 3rd Edition, McGraw-Hill India Education Private Ltd.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, TataMcGraw-Hill, 2002.
3. William Stallings, "Computer Organization and Architecture", 9th Edition, Pearson.
4. David A. Patterson, John L. Hennessy: "Computer Organization and Design – The Hardware /Software Interface ARM Edition", 4th Edition, Elsevier, 2009.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
MA402BS	**Computer Oriented Statistical Methods**	3	1	0	4

Course Description: The course contains the theory of Probability, Probability distributions of single variable, The sampling theory, testing of hypothesis and making statistical inferences, Methods of Estimation,Stochastic process and Markov chains.

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

C402.1: Distinguish between discrete and continuous random variables
C402.2: Analyze and interpret statistical data using appropriate probability distributions
C402.3: Apply sampling distributions in real world problems
C402.4: Estimate the value for a given parameter by choosing appropriate method
C402.5: Apply suitable test to accept or reject a given hypothesis
C402.6: Apply Stochastic process and Markov process to solve various problems

Unit – I Probability

Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Baye's Rule, Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions and Continuous Probability Distributions.

Unit – II Expectation and Discrete distributions

Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev's Theorem.
Discrete Probability Distributions: Binomial Distribution, Poisson distribution.

Unit – III Continuous and Sampling Distributions

Uniform Distribution, Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial Distributions.
Fundamental Sampling Distributions: Random Sampling, Some Important Statistics, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, t - Distribution, F-Distribution.

Unit – IV Sample Estimation and Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation, Single Sample: Estimating the mean, standard error of a point estimate, prediction interval. Two sample: Estimating the difference between two means, Single sample: Estimating a proportion, Two samples: Estimating the difference between two proportions, Two samples: Estimating the ratio of two variances.
Statistical Hypothesis: General Concepts, Testing a Statistical Hypothesis, Single sample: Tests concerning a single mean, Two samples: tests on two means, One sample: test on a single proportion. Two samples: tests on two proportions, Two- sample tests concerning variances.

Unit – V Stochastic Processes and Markov Chains

Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n-step transition probabilities, Markov chain, Steady state condition, Markov analysis.

TEXT BOOKS

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics For Engineers & Scientists, 9th Edition, Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, Khanna Publications.
3. S.D.Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi.

REFERENCE BOOKS

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, 2004, John Wiley & Sons, Ltd.
2. Sheldon M Ross, Probability and Statistics for Engineers and Scientists, Academic Press.
3. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
CS403PC	**Operating Systems**	3	0	0	3

Course Description: This course covers concepts viz., CPU Scheduling, Process Management, Synchronization, Virtual Memory, Memory Allocation Methods, File Management
etc.,

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

C403.1: Understand basic concepts of System Structures, Process and Threads.
C403.2: Evaluate CPU scheduling algorithms and deadlock handling mechanisms
C403.3: Apply various mechanisms to achieve synchronization.
C403.4: Identify suitable mechanisms for Inter Process Communication.
C403.5: Choose appropriate Memory Management techniques.
C403.6: Implement efficient File Management techniques through System Calls.

Unit – I Introduction

Introduction: System Structures, Operating System Services, User OS Interface, System Callsand Types, System Programs.
Process: Process Concept, Process Scheduling, Operations on Processes.
Multithreaded Programming: Overview, Multithreading Models.

Unit – II CPU Scheduling

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.System Call Interface for Process Management-fork, exit, wait, waitpid, exec.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Unit – III Process management and Synchronization

Process Management and Synchronization: The Critical Section Problem, SynchronizationHardware, Semaphores, Classical Problems of Synchronization, Monitors.
Inter Process Communication Mechanisms: IPC using Pipes, FIFOs, Message Queues, Shared
Memory.

Unit – IV Memory Management and Virtual Memory

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation.

Virtual Memory: Demand Paging, Page Replacement, Page Replacement Algorithms.

Unit – V File System Interface and operations

File System Interface: Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management.

File Operations: Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

TEXT BOOKS

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles - Sixth Edition, John Wiley.
2. W. Richard Stevens, Stephen A. Rago, Advanced programming in the UNIX Environment, Pearson Education.

REFERENCE BOOKS

1. William Stallings, Operating Systems - Internals and Design Principles, Fifth Edition- 2005, Pearson Education/PHI.
2. Crowley, Operating System A Design Approach, TMH.
3. Andrew S. Tanenbaum, Modern Operating Systems, 2nd edition, Pearson/PHI.
4. Kernighan and Pike, UNIX programming environment, PHI/ Pearson Education.
5. U. Vahalia, UNIX Internals - The New Frontiers, Pearson Education.
6. Andrea Arpaci-Dusseau and Remzi Arpaci-Dusseau, Operating Systems: Three Easy Pieces.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
SM404MS	**Business Economics and Financial Analysis**	3	0	0	3

Course Description: The course contains various topics related to forms of Business and the impact of economic variables on the Business. It includes the Demand, Supply, Production, Cost, Market Structure and Pricing aspects in business. The Students can study the firm's financial position by analyzing the Financial Statements of a Company which can be used in their engineering career development.

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

C404.1: Understand the Economic Concepts in business decision making process.
C404.2: Familiarize with the cost concepts, market structures.
C404.3: Make use of break-even analysis, CVP Analysis, pricing strategies.
C404.4: Examine financial accounting and analyze various financial statements.
C404.5: Interpret various financial statements by applying different types of ratios.
C404.6: Examine the usefulness of Investment decisions of a company.

Unit – I Introduction to Business and Economics

Business: Introduction to business, Structure of Business Firm, Types of Business Entities: Sole Proprietorship, Partnership, Limited Liability Company & Co-operatives, Sources of Capital for a Company: Conventional, Non-Conventional Sources of Finance. Theory of Firm.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

Unit – II Demand and Supply Analysis

Demand: Demand Determinants, Law of Demand

Elasticity of Demand: Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

Unit – III Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Perfect competition, Monopoly, Oligopoly, Monopolistic Competition: Features and Price Determination.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

Unit – IV Financial Accounting

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

Unit – V Financial Analysis Through Ratios

Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

TEXT BOOKS

1. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw-Hill Education Pvt. Ltd. 2012.
2. D.D.Chaturvedi, S.L.Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
3. Dhanesh K Khatri, Financial Accounting, Tata McGraw–Hill, 2011.

REFERENCE BOOKS

1. S.N.Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.
2. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
3. Managerial Economics: Theory and Applications, D.M. Mithani, Himalaya Publishing House, 2017.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
IT405PC	Java Programming	2	0	0	2

Course Description: This course introduces the fundamental concepts of Java programming language, focusing on Object Oriented Programming principles, exception handling, file I/O, Java utility classes, Collection framework, Multi-Threading, JDBC concepts, and GUI-based components.

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

C405.1: Illustrate Object Oriented concepts and basics of Java programming.
C405.2: Effectively Handle Exceptions and File I/O Operations.
C405.3: Make use of the concepts of packages and utility classes.
C405.4: Utilize the collection framework in Java applications.
C405.5: Implement the concepts of multithreading and JDBC.
C405.6: Develop real-time GUI applications using AWT, and Swings.

Unit – I Foundations of Java and OOP Principles

Foundations of Java: History of Java, Java Features, Variables, Data Types, Arrays, Operators, Expressions, Control Statements. Elements of Java - Class, Object, Methods, Constructors and Access Modifiers, Generics, Annotations, Lambda Expressions, Inner classes and String class

OOP Principles: Encapsulation – concept, setter and getter method usage, this keyword. Inheritance - concept, Inheritance Types, super keyword. Polymorphism – concept, Method Overriding usage, and Type Casting. Abstraction – concept, abstract keyword and Interface.

Unit – II Exception Handling, Files, and I/O Streams

Exception Handling: Exception and Error, Exception Types, Exception Handler, Exception Handling Clauses – try, catch, finally, throws and the throw statement, Built-in-Exceptions and Custom Exceptions.

Files and I/O Streams: The file class, Streams, The Byte Streams, The Character Streams.

Unit – III Packages and Collections

Packages - Defining a Package, CLASSPATH, Access Specifiers, importing packages. Few Utility Classes - String Tokenizer, BitSet, Date, Calendar, Random, Formatter, Scanner.

Collections: Collections overview, Collection Interfaces, Collections Implementation Classes, Sorting in Collections, Comparable and Comparator Interfaces.

Unit – IV Multithreading and Java Database Connectivity

Multithreading: Process and Thread, Differences between thread-based multitasking and process-based multitasking, Java thread life cycle, creating threads, thread priorities, synchronizing threads, inter-thread communication.

Java Database Connectivity: Types of Drivers, JDBC architecture, JDBC Classes and Interfaces, Basic steps in Developing JDBC Application, Creating a New Database and Table with JDBC.

Unit – V Swing and Event Handling

GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Layout Manager Classes, and Simple Applications using AWT and Swing.

Event Handling - The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, and Adapter classes.

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference", 9th Edition, McGraw-Hill Education,Pvt. Ltd.
2. Deitel, "Java How to Program", 7th Edition, Pearson Education.

REFERENCE BOOKS

1. J. Nino and F.A. Hosch, John Wiley & sons, "An Introduction to Programming and OO design using Java".
2. Y. Daniel Liang, "Introduction to Java Programming", Pearson Education.
3. P. Radha Krishna, "Object Oriented Programming through Java", University Press.
4. S. Malhotra, S. Chudhary, "Programming in Java", 2nd edition, Oxford Univ. Press.
5. R. A. Johnson, "Java Programming and Object-oriented Application Development", Cengage Learning.
6. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
CS406PC	**Operating Systems Lab**	**0**	**0**	**2**	**1**

Course Description: This lab course implements Operating System concepts such as CPU Scheduling, Process Management through System Calls, Deadlock Management, Inter Process Communication, Semaphores, Memory Management, File Management, etc.

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

C406.1: Evaluate CPU Scheduling Algorithms and Memory management techniques.

C406.2: Construct deadlock detection and avoidance algorithms.

C406.3: Solve classical problems of synchronization using semaphores.

C406.4: Evaluate Inter process communication mechanisms.

LIST OF PROGRAMS

Cycle 1:

1. Write a program to simulate the following CPU Scheduling algorithms.
   a) FCFS b) SJF c) Round Robin d) priority
2. a) Write a program to implement Process management system calls viz., fork, exit, wait, waitpid, exec.
   b) Write a program to implement I/O system calls viz., open, read, write, close, seek, stat, opendir, readdir.
3. Write a program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.

Cycle 2:

4. Write a program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.
5. Write a program to illustrate the following IPC mechanisms
   a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write a program to simulate the following memory management techniques
   a) Paging b) Segmentation
7. Write a program to simulate Contiguous Memory Allocation techniques
   a) First-Fit b) Best-Fit c) Worst-fit
8. Write a program to stimulate Page Replacement Algorithms
   a) FCFS b) LRU c) Optimal

TEXT BOOKS

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, “Operating System Principles”,7th Edition, John Wiley.
2. W.R.Stevens, “Advanced programming in the Unix environment”, Pearson education.

REFERENCE BOOKS

1. William Stallings, “Operating Systems – Internals and Design Principles”, Fifth Edition– 2005, Pearson Education/PHI.
2. Crowley, “Operating System - A Design Approach”, TMH.
3. Andrew S Tanenbaum, “Modern Operating Systems”, 2nd edition, Pearson/PHI.
4. Kernighan and Pike, “UNIX Programming Environment”, PHI/Pearson Education.
5. U. Vahalia, “UNIX Internals: The New Frontiers”, Pearson Education.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
CS407PC	**Node JS/ React JS/ Django**	0	0	2	1

Course Description: This lab course used to develop dynamic web applications using different frameworks and deploy them.

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

C407.1: Build a custom website with HTML, CSS, and Bootstrap and little JavaScript.

C407.2: Demonstrate Advanced features of JavaScript and learn about JDBC.

C407.3: Develop Server – side implementation using Java technologies.

C407.4: Develop the server – side implementation using Node JS.

List of Programs

Cycle 1:

1. Build a responsive web application for E-Book management system with registration, login, catalog and cart pages using CSS3 features, flex and grid. Description of application given in Ebook system of Software Engineering.
2. Make the above web application responsive web application using Bootstrap framework for E-ticketing system. Description of application given in E-ticketing of Software Engineering.
3. Use JavaScript for doing client – side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Develop a java standalone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.
6. Create an xml for the bookstore. Validate the same using both DTD and XSD. Description of application given in Book Bank of Software Engineering.
7. Design a controller with servlet that provides the interaction with application developed in experiment 1 and the database created in experiment 5.

Cycle 2:

8. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)
9. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
10. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)
11. For the above application create authorized end points using JWT (JSON Web Token).
12. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.
13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js
14. Create a TODO application in react with necessary components and deploy it into Github.
15. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.

REFERENCE BOOKS

1. Jon Duckett, “Beginning HTML, XHTML, CSS, and JavaScript”, Wrox Publications, 2010**.**
2. Bryan Basham, Kathy Sierra and Bert Bates, “Head First Servlets and JSP”, O’Reilly Media, 2nd Edition, 2008.
3. Vasan Subramanian, Pro MERN Stack, “Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, A Press.

B.Tech. II Year II Semester

Course Code	Course Title	L	T	P	Credits
IT409PC	**Java Programming Lab**	0	0	2	1

Course Description: This lab course covers essential concepts and tools in Java programming, including IDE usage, basic syntax, string handling, object-oriented principles, exception handling, and file I/O operations. It also explores advanced topics such as collection classes, multithreading, database operations, GUI development, and event handling.

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

C409.1: Implement Java programs to tackle real-world problems by applying Object- Oriented Programming (OOP) principles effectively.
C409.2: Utilize Exception Handling methodologies to enhance program robustness and error management.
C409.3: Construct applications with multitasking capabilities using multithreading techniques and integrate database access through JDBC.
C409.4: Design Java Swing-based graphical user interface (GUI) programs with intuitive user experiences.

List of Programs

Cycle 1:

1. Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Implement the following string handling methods for any given string [concat( ), compareTo( ), equals( ), indexOff( ), split( ), getChars( ) and trim( )].
3. Write a Java program to demonstrate the OOP principles. [i.e., Encapsulation, Inheritance, Polymorphism and Abstraction]
4. Write a Java program to handle checked and unchecked exceptions. Also, demonstrate the usage of custom exceptions in real time scenario.
5. Write a Java program on Random Access File class to perform different read and write operation.

Cycle 2:

6. Write a Java program to demonstrate the working of different collection classes. [Use package structure to store multiple classes].
7. Write a program to synchronize the threads acting on the same object. [Consider the example of any reservations like railway, bus, movie ticket booking, etc.]
8. Write a program to perform CRUD operations on the student table in a database using JDBC.
9. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. [Use Adapter classes]**.**

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference", 9th Edition, McGraw-Hill Education(India)Pvt. Ltd.
2. Deitel, "Java How to Program", 7th Edition, Pearson Education.

REFERENCE BOOKS

1. J. Nino and F.A. Hosch, John Wiley & sons, "An Introduction to Programming and OO designusing Java".
2. Y. Daniel Liang, "Introduction to Java Programming", Pearson Education.
3. P. Radha Krishna, "Object Oriented Programming through Java", University Press.
4. S. Malhotra, S. Chudhary, "Programming in Java", 2nd Edition, Oxford Univ.Press.
5. R. A. Johnson, "Java Programming and Object-oriented Application Development", CengageLearning.
6. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, PearsonEducation.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
MC410	**Gender Sensitization Lab** **(An Activity-based Course)**	0	0	2	0

Course Description: This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course: After completion of this course, the students will be able to

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I Understanding Gender

Introduction: Introduction to Gender, What is Gender, Why should we study it.. Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste: Different Masculinities.

Unit-II Gender Roles And Relations

Two or Many? -Struggles with Discrimination- Missing Women-Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences- Gender Spectrum: Beyond the Binary

Unit-III Gender And Labour

Division & Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

Unit-IV Gender - Based Violence

Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…." Additional Reading: The Caste Face of Violence.

Unit-V Gender And Coexistence

Gender Issues- Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks The Brave Heart.

TEXT BOOK

1. A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, Towards a World of Equals: A Bilingual Textbook on Gender, 2015, Telugu Akademi, Hyderabad, Telangana.

E-TEXT BOOK

1. Abdulali Sohaila, I Fought For My Life… and Won, Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

REFERENCE BOOKS

1. Menon, Nivedita, Seeing like a Feminist, 2012, New Delhi: Zubaan-Penguin Books.
2. Abdulali Sohaila, I Fought For My Life…and Won, Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT501PC	**Software Engineering**	3	0	0	3

Course Description: This course discusses principles of software engineering, process models and software requirements. It also explores design principles, testing strategies and risks in software development

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

C501.1: Illustrate software process framework and models for the development of software application.

C501.2: Analyze and validate the requirement engineering strategy for developing software requirement specification documents

C501.3: Choose an appropriate model to create an architectural design.

C501.4: Apply various testing strategies to verify the software quality.

C501.5: Illustrate the importance of framework for product metrics.

C501.6: Identify the risk strategy and QA techniques for developing quality software

Unit – I Introduction to Software Engineering

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI)**.**

Process models: The waterfall model, Spiral model, and Agile methodology.

Unit –II Requirement Engineering

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

Unit –III Design Engineering

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modelling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Unit – IV Testing

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Metrics for Process and Products: Software measurement, metrics for software quality.

Unit – V Risk Management

Risk Management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.
Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS

1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach", 6th edition, McGraw-Hill International Edition.
2. Somerville, "Software Engineering", 7th edition, Pearson Education.

REFERENCE BOOKS

1. Booch, Grady, "The Unified Modelling Language User Guide", Pearson Education India, 2005.
2. Peters, James F, and Witold Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons, Inc., 1998.
3. Waman S Jawadekar, "Software Engineering Principles and Practice", The McGraw-Hill Companies,2004
4. Page-Jones, Meilir, "Fundamentals of object-oriented design in UML", Pearson Education India, 2000.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT502PC	**Data Communications and Computer Networks**	3	1	0	4

Course Description: This course thoroughly examines essential networking principles and technologies. It also covers the functionalities, design issues and protocols related to the ISO/OSI and TCP/IP models.

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

C502.1 Understand the basics of communication and computer networks.
C502.2 Analyze various link and access control mechanisms in the data link layer.
C502.3 Design subnets and calculate the IP addresses to fulfill the network requirements of an organization.
C502.4 Apply various routing algorithms for best effort delivery service.
C502.5 Choose appropriate transport layer protocol for reliable/unreliable communication.
C502.6 Analyze the features and operations of various application layer protocols.

Unit – I Data Communications Concepts and Physical layer

Data Communications Concepts: Components, Data Representation, Data flow, Networks, The Internet, Protocols and Standards, OSI model, Layers in OSI model, TCP/IP protocol suite, addressing.

Physical layer: Transmission modes, Transmission Media, Switching - Datagram Networks, Virtual Circuit Networks.

Unit – II Data link layer

Data link layer: Introduction, Error Detection and Correction - Hamming code, CRC, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocol. Medium Access sublayer: Random access, Controlled access, Channelization. WiFi (IEEE 802.11), WiFi-6, SDWAN.

Unit – III Network layer

Network layer: Logical Addressing, Internet Protocol: Internetworking, IPv4, IPv6, Translation from IPv4 to IPv6, Address mapping.

Network layer Delivery, Forwarding, Routing Protocols - DVR, OSPF, BGP.

Unit – IV Transport Layer

Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services.

Unit – V Application Layer

Application Layer: Domain Name Space (DNS), Distribution of Name Space, DNS on the Internet, Electronic Mail, WWW, HTTP(S).

TEXT BOOK

1. Data Communications and Networking, Behrouz A. Forouzan, Fourth Edition TMH.

REFERENCE BOOKS

1. Computer Networks, Andrew S Tanenbaum, 6th Edition. Pearson Education.
2. Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose & Keith W. Ross, 3rd Edition, Pearson Education
3. Data Communications and Computer Networks, P.C Gupta, PHI.
4. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT503PC	Algorithm Design and Analysis	3	0	0	3

Prerequisite Data Structures

Course Description: This course covers performance of algorithms, algorithmic design paradigms, modeling of problems using disjoint sets, priority queues and graphs, classification of problems into P & NP classes.

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

C503.1: Analyze the performance of the algorithms and represent using relevant notations.
C503.2: Apply the concepts of disjoint sets and priority queues to solve real world problems.
C503.3: Choose appropriate algorithmic design paradigms to solve various real-world problems.
C503.4: Identify the issues in graph connectivity and resolve them.
C503.5: Reduce the search space of a problem using bounding functions.
C503.6: Categorize problems into NP hard & NP Complete.

Unit – I Introduction, Disjoint Sets, Basic Traversal and Search Techniques

Introduction: Algorithm, Performance Analysis-Space and Time complexity, Asymptotic Notations.

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heap sort.

Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, strongly connected components.

Unit– II Divide and conquer and Greedy method

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

Greedy method: General method, applications- Job sequencing with deadlines, fractional knapsack problem, Minimum cost spanning trees, Single source shortest path problem- Dijkstra's, Huffman Coding.

Unit–III Dynamic Programming

Dynamic Programming: General method, applications- Single source shortest path problem- Bellman Ford, All pairs shortest path problem, 0/1 knapsack problem, Reliability design, Travelling salesperson problem.

Unit–IV Backtracking, Branch and Bound

Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, Hamiltonian cycles

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

Unit – V NP-Hard and NP-Complete problems

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

TEXT BOOKS

1. Ellis Horowitz, Satraj Sahni and Rajasekharan, "Fundamentals of Computer Algorithms", University Press.
2. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", 2nd Ed, PHI

REFERENCE BOOKS

1. Aho, Ullman and Hopcroft, Design and Analysis of algorithms, Pearson education.
2. M.T. Goodrich and R.Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley and sons.
3. Anany levitin, Introduction to The design and analysis of algorithms.
4. Data Structures and Algorithm Analysis in C by Mark Allen Weiss
5. Fundamentals of algorithmics by Gilles Brassard, Fairy Meadow, Paul Bratley and Pointe-Claire

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT511PE	**Full Stack Development (Professional Elective - I)**	3	0	0	3

Prerequisite Node JS/React JS/ Django

Course Description: This course contains full-stack components such as Node.js, MongoDB, Express, React, and Angular JS to develop a web page.

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

C511.1: Understand the Full-stack components for developing web applications.
C511.2: Apply packages of NodeJS to work with Data, Files, HTTP Requests and Responses.
C511.3: Use MongoDB database for storing and processing huge data.
C511.4: Explore MongoDB database connection with NodeJS application.
C511.5: Design faster and more effective single-page applications using Express and Angular.
C511.6 Create interactive user interfaces with react components.

Unit – I Introduction to Full Stack Development

Basic Web Development Framework: User, Browser, Webserver, Backend Services
Full Stack Components: Node.js, MongoDB, Express, React, Angular.

Unit – II Node.js

NodeJS: Understanding Node.js, Working with Node Packages, creating a Node.js Application, Understanding the Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks.
Accessing the File System from Node.js: Opening, Closing, Writing, Reading Files, Understanding Request, Response, and Server Objects, Implementing HTTP service in Node.js.

Unit – III MongoDB

Understanding NoSQL and MongoDB, Building the MongoDB Environment, MongoDB CURD operations, Accessing and Manipulating MongoDB Collections.
Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, and objects Used in the MongoDB Node.js Driver.

Unit – IV Express and Angular

Getting Started with Express: Configuring Routes, Using Requests and Response Objects.
Angular: importance of Angular, Understanding Angular, creating a Basic Angular Application, Angular Components, Expressions, Data Binding, Built-in Directives, Custom Directives, Implementing Angular Services in Web Applications.

Unit – V React

Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React.
Rendering and Life Cycle, Methods in React, working with forms in React, integrating third-party libraries, Routing in React.

TEXT BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley, 2019.
2. Mark Tielens Thomas, "React in Action", 1st Edition, Manning Publications.

REFERENCE BOOKS

1. Vasan Subramanian, Pro MERN Stack, "Full Stack Web App Development with Mongo, Express, React, and Node", 2nd Edition, Apress, 2019.
2. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", 1st edition, Apress, 2018.
3. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", 2nd edition, Addison-Wesley Professional, 2018.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT512PE	**Data Mining (Professional Elective – I)**	3	0	0	3
Prerequisite	Probability and Statistics				

Course Description: This course covers the concepts such as discovering patterns, correlations, anomalies, trends within large datasets to extract useful information and make informed decisions. This course also introduces the techniques, and algorithms used in data mining.

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

C512.1	Examine data mining tasks, KDD process, challenges and data types of data.
C512.2	Apply Data Pre-processing techniques to make data sets ready for mining.
C512.3	Understand the fundamental concepts of classification.
C512.4	Classify the real world data into appropriate classes using various supervised learning techniques and measure its performance.
C512.5	Identify the frequent patterns and association rules in transactional datasets.
C512.6	Apply clustering and outlier detection techniques to given data sets and evaluate goodness measures.

Unit – I Data Mining

Introduction – Data mining, Kinds of data to be mined, Kinds of patterns to be mined, Technologies used, Applications of data mining, Major Issues in Data Mining.
Know Your Data – Data Objects and Attribute types, Basic statistical descriptions of data, Data visualization, Measuring data similarity and dissimilarity.

Unit – II Data Preprocessing

Data Preprocessing – Overview, Data cleaning- Missing values, Noisy data, Data cleaning as a process, Data integration - Entity identification problem, Redundancy and correlation analysis, Tuple duplication, Data value conflict detection and resolution.
Data Reduction & Transformation – Overview of data reduction strategies, Principal Component Analysis, Attribute subset selection, Parametric data reduction, Histograms, Clustering, Sampling, Data cube aggregation, Data transformation and Data discretization.

Unit – III Classification

Classification - Basic concepts, Decision tree induction, Bayesian classification, Rule based classification, Model evaluation and selection, Lazy Learner.

Unit – IV Association Rule Mining

Mining Frequent Patterns – Basic concepts, Frequent itemset mining methods, Pattern evaluation methods.
Advanced Pattern Mining – Pattern mining in multilevel, Multidimensional space, Constraint-Based frequent pattern mining, Mining High-dimensional data and Colossal patterns, Pattern exploration and Application.

Unit – V Clustering and Application

Cluster analysis, Partitioning methods, Hierarchical methods, Density based methods, Grid based methods, Evaluation of clustering.

Outlier Detection – Outlier Analysis, Outlier detection methods, Statistical approaches, Proximity based approaches.

TEXT BOOK

1. Jiawei Han & Micheline Kamber, "Data Mining – Concepts and Techniques", 3rd Edition, Elsevier.

REFERENCE BOOKS

1. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Second Edition, Morgan Kaufmann, 2005.
2. Margaret H Dunham, "Data Mining Introductory and Advanced topics", PEA.
3. Arun K Pujari, "Data Mining Techniques", Universities Press, 3rd Edition.

B.Tech. III Year I Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
IT513PE	**Mobile Application Development (Professional Elective –I)**	3	0	0	3
Prerequisite	Java Programming				

Course Description: The course contains various concepts of mobile application development such as UI, broadcasts, receivers and notifications. It also elucidates persistence storage, shared preferences and database connection with SQLite.

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

C513.1:	Illustrate the features, components and life cycle of Android Operating system
C513.2:	Design Android applications with UI components, Fragments and event handling.
C513.3:	Identify the importance of intents in Android applications development
C513.4:	Develop Android applications using broadcasts and notifications
C513.5:	Implement data persistence mechanisms using both Files and Shared Preferences in Android applications
C513.6:	Develop Android applications using SQLite database management and location-based services.

Unit – I Introduction

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

Unit – II Android User Interface

Android User Interface: Building user interface – Fundamental Android UI Design, Android User Interface Fundamentals, Introducing Layouts, Optimizing Layouts, Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities.
The Android Widget Toolbox, Handling User Interaction Events
Advanced User Experience - Resolution Independence, Supporting and Optimizing for Different Screen Sizes.

Unit – III Intents and Broadcasts – Receivers - Notifications

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Returning results from Activities, Native Android Actions, **Broadcast Receivers** – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity
Notifications – Creating and Displaying notifications, Displaying Toasts, using Intent to dial a number or to send SMS

Unit – IV Shared Preferences, File System

Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

Working with the File System - Using application specific folders and files, creating files, reading data from files, File-Management Tools, Using Application-Specific Folders to Store Files, Creating Private Application Files, Using the Application File Cache, Storing Publicly Readable Files**.**

Unit – V Connecting to database - SQLite

Database – Introduction to SQLite database, creating and opening a database
Creating Content Providers - Registering Content Providers, using content Providers (insert, delete, retrieve and update)
Location Based Services - Using the Emulator with Location-Based Services, Selecting a Location Provider, Finding Your Current Location**.**

TEXT BOOK

1. Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox), 2012

REFERENCE BOOKS

1. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013
2. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013

B. Tech. III Year I Semester					
Course Code	**Course Title**	**L**	**T**	**P**	**Credits**
IT514PE	**Software Testing Methodologies (Professional Elective – I)**	3	0	0	3
Prerequisite	Software Engineering				

Course Description This Course provides a comprehensive overview of various software testing methodologies, techniques and best practices to ensure the delivery of high-quality software products. This course also deals with the principles and processes involved in testing software applications from unit testing to system testing.

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

C514.1: Understand the software testing foundations and bugs.

C514.2: Apply suitable testing techniques for representation of flow graphs.

C514.3: Apply dataflow and interface testing techniques for identifying nice and ugly domains.

C514.4: Choose appropriate path expression, KV charts for logic based testing strategies.

C514.5: Examine the state graphs for state testing and the testability tips.

C514.6: Explore graph matrices, matrix properties and node reduction algorithms.

Unit – I Software Testing fundamentals

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 Testing types- Transaction flow testing and Domain testing

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: Domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domains and testability

Unit – III Path testing and Logic based Testing

Paths, Path products and Regular expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, KV charts, specifications.

Unit – IV State Testing and Transition Testing

State, State Graphs and Transition Testing: State graphs, good & bad state graphs, state testing, Testability tips.

Unit – V Applications of Graph Matrices

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, Building Tools (Students should be given an exposure to a tool like JMeter or Win-runner).

TEXT BOOK

1. Baris Beizer, “Software Testing Techniques”, Second edition, Dreamtech

REFERENCE BOOKS

1. Brian Marick, “The craft of software testing”, Pearson Education.
2. Dr. K. V. K. K. Prasad, “Software Testing Tools”, Dreamtech**.**
3. Edward Kit,” Software Testing in the Real World”, Pearson Education.
4. Perry, “Effective methods of Software Testing”, John Wiley.
5. Meyers, “Art of Software Testing”, John Wiley.
6. SPD, “Software Testing Techniques”, O’ Reilly

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT521PE	**Computer Graphics (Professional Elective – II)**	3	0	0	3
Prerequisites	Engineering Graphics, Programming for Problem Solving				

Course Description: This course contains the fundamentals of drawing and filling primitives, exploring the attributes associated with output primitives, understanding both two-dimensional and three-dimensional geometric transformations, and delving into the concepts of two-dimensional and three-dimensional viewing.

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

C521.1: Explain application of computer graphics and apply different algorithms for drawing line, circle, polygon and polygon filling.

C521.2: Determine effects of Two-Dimensional geometric transformations on points, lines and planes.

C521.3: Explain window to view-port transformation.

C521.4: Apply various clipping algorithms.

C521.5: Elaborate interpolation of line and space curves using Splines and Bezier curves.

C521.6: Determine the effects of Three-Dimensional geometric transformations on Three-Dimensional objects and explain the method of Three-Dimensional viewing and clipping

Unit – I Introduction, Output primitives, Polygon Filling

Introduction: Application areas of Computer Graphics, overview of graphics systems.
Output primitives: Points and lines, line drawing algorithms (DDA and Bresenham's Algorithm) circle- generating algorithms and ellipse - generating algorithms.
Filled Area primitives: Scan-line polygon fill algorithm, boundary-fill, flood-fill algorithm, Attributes of Output primitives- line attributes and curve attributes.

Unit – II Two-Dimensional Geometric Transformations

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations, transformations between coordinate systems.

Unit – III Two-Dimensional Viewing

The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Clipping operations, point clipping, Line clipping-Cohen Sutherland algorithms, Polygon clipping-Sutherland Hodgeman polygon clipping algorithm.

Unit – IV Three-Dimensional Object Representation

Polygon surfaces, quadric surfaces, spline representation, Bezier curve, B-Spline curves, Bezier and B-Spline surfaces.

Unit – V Three-Dimensional Geometric and Modelling Transformations

Translation, rotation, scaling, reflection and shear, composite transformations.

Three-dimensional viewing: Viewing pipeline, viewing coordinates, projections, view volume, General perspective- Projection Transformation, clipping.

TEXT BOOK

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version", Pearson Education.

REFERENCE BOOKS

1. David F Rogers, Tata Mc Graw hill, "Procedural elements for Computer Graphics", 2nd Edition.
2. Neuman and Sproul,"Principles of Interactive Computer Graphics", TMH.
3. Shalini Govil, Pai, "Principles of Computer Graphics", Springer 2005.
4. Foley, VanDam, Feiner and Hughes,"Computer Graphics Principles & Practice", 2nd Edition in C, Pearson Education.
5. Steven Harrington, "Computer Graphics", TMH.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
IT522PE	**Information Retrieval Systems (Professional Elective – II)**	3	0	0	3
Prerequisites	Data Structures, Database Management Systems				

Course Description: The course aims to provide the concepts of information retrieval and their application to locate relevant information in a large corpus of documents.

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

C522.1:	Understand Information Retrieval Systems' (IRS) principles, capabilities, and functionalities.
C522.2:	Choose appropriate data structure, file structure and indexing mechanism for efficient retrieval.
C522.3:	Differentiate among various classes of automatic indexing methods and clustering techniques.
C522.4:	Select suitable search technique based on the context.
C522.5:	Apply visualization techniques for efficient presentation of information.
C522.6:	Make use of the algorithms for different media data.

Unit – I Introduction to Information Retrieval Systems and its capabilities

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Unit – II Indexing and Data Structures

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Information Extraction

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Unit – III Automatic Indexing and Clustering

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

Unit – IV Searching and Visulaization

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

Unit – V Text and Multimedia based Information Retrieval

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval (MIR): Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

TEXT BOOK

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury.

REFERENCE BOOKS

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.
4. Modern Information Retrieval by Yates and Neto Pearson Education.

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT523PE	**Distributed Databases (Professional Elective – II)**	3	0	0	3
Prerequisite	Database Management Systems				

Course Description: This course enriches the previous knowledge of database systems and exposes the need for distributed database technology to overcome the deficiencies of the centralized database systems.

Course Outcomes: After Completion of this course, the students will be able to

C523.1: Analyze the architecture and design of distributed database systems.

C523.2: Explore the objectives and algorithms for distributed query processing.

C523.3:: Apply the mechanisms for concurrency control and deadlock management.

C523.4 Evaluate the measures for distributed systems reliability and fault tolerance.

C523.5: Choose the appropriate parallel database system architecture for implementation

C523.6: Implement distributed object database management and data management systems.

Unit – I Distributed DBMS Architecture and Design

Introduction; Distributed Data Processing, Distributed Database System, Promises of DDBSs, Complications and Design Issues.

Distributed DBMS Architecture: Architectural Models for Distributed DBMS, Autonomy, Distribution, Heterogeneity, Architectural Alternatives, Client/Server Systems, Peer-to-Peer Systems, Multi database System Architecture

Distributed Database Design: Top-Down Design Process, Distribution Design issues, Fragmentation, Allocation.

Unit – II Query Processing and Optimization

Query processing and decomposition: Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.

Distributed query Optimization: Query optimization, centralized query optimization, Join Ordering in Distributed Queries, distributed query optimization algorithms.

Unit – III Transaction Management and Concurrency Control

Transaction Management: Definition, properties of transaction, types of transactions.

Distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.

Unit – IV Reliability and Parallel Database Systems

Distributed DBMS Reliability: Reliability concepts and measures, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.

Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.

Unit – V Distributed Object Database Management Systems and Data Management

Distributed Object Database Management Systems: Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.
Data Management: Data Stream Management, Cloud Data Management

TEXT BOOKS

1. M. Tamer OZSU and Patuck Valduriez: "Principles of Distributed Database Systems", Pearson. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti, "Distributed Databases", McGraw Hill.

REFERENCE BOOK

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT524PE	Pattern Recognition (Professional Elective-II)	3	0	0	3

Course Description: This course provides foundational concepts, theories, and algorithms essential for pattern recognition and machine learning. The course covers various paradigms and data structures for pattern representation, proximity measures, feature extraction, Classification and Clustering tasks.

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

C524.1: Understand the significance of pattern recognition and its diverse representation methods.
C524.2: Analyze the variants of the Nearest Neighbor algorithm and Bayes Classifier.
C524.3: Apply Hidden Markov Models and decision trees to solve problems.
C524.4: Apply Support Vector Machines and Ensemble learning techniques for Classification tasks.
C524.5: Apply clustering algorithms effectively for large and high-dimensional data.
C524.6: Apply acquired knowledge in categorizing hand-written digit dataset.

Unit – I Introduction to Pattern Recognition and Data Representation

Introduction: Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition.

Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering

Unit – II Nearest Neighbor and Bayes Classifier

Nearest Neighbor Based Classifier: Nearest Neighbor Algorithm, Variants of the NN Algorithm, use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection.

Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

Unit – III Hidden Markov Models and Decision Trees

Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification using HMMs.

Decision Trees: Introduction, Decision Tree for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

Unit – IV Support Vector Machines and Classifier Combination

Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification.

Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

Unit – V Clustering Algorithms and Application in Handwritten Digit Recognition

Clustering: Importance of clustering, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets.
An Application-Handwritten Digit Recognition: Description of the Digit Data, Preprocessing of Data, Classification Algorithms, Selection of Representative Patterns, Results.

TEXT BOOK

1. Murty, M. Narasimha, Devi, V. Susheela, "Pattern Recognition: An Algorithmic Approach", Spinger Pub, 1st Ed.

REFERENCE BOOKS

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill.
2. Lawrence Rabiner and Bing-Hwang Juang, "Fundamentals of Speech Recognition", Prentice Hall Pub.

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT504PC	**Software Engineering & Computer Networks Lab**	0	0	2	1

Course Description: The software engineering lab is designed to formulate problem statements, collect requirements, design UML diagrams, and develop test cases. The computer networks lab contains the implementation of various functionalities of data link, network, and transport layer protocols.

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

C504.1: Formulate Problem statements, transform user requirements into software requirements, and identify potential risks.
C504.2: Design UML diagrams using CASE tools and develop Test Cases
C504.3: Implement various Framing methods, Error Control methods, and Sliding window protocol.
C504.4: Apply routing protocol, congestion control mechanism and analyze traffic using Wireshark.

List of Experiments

Cycle 1: Software Engineering

Do the following seven exercises for any two projects given in the list of sample projects or any other Projects:

1. Identification of the problem statement.
2. Preparation of Software Requirement Specification Document.
3. Preparation of Software Configuration Management and Risk Management related documents.
4. Usage of any Design phase CASE tool
5. Performing the Design by using any Design phase CASE tools.
6. Develop test cases for unit testing and integration testing.
7. Develop test cases for various white box and black box testing techniques.

Sample Projects:

1. Passport Automation System
2. Book Bank
3. Online Exam Registration

Cycle 2: Computer Networks

1. Implement the data link layer framing methods such as character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC-32
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the selective repeat mechanism.
4. Implement Dijsktra's algorithm to compute the shortest path through a network
5. Write a program for congestion control using the Token Bucket algorithm.
6. Wireshark
    i. Starting Wire shark.
    ii. Packet Capture Using Wireshark.
    iii. Viewing Captured Traffic.

REFERENCE BOOKS

1. Roger S. Pressman, “Software Engineering, A practitioner’s Approach,” 6th edition, McGraw-Hill International Edition.
2. Dan Pilone, Neil Pitman, “UML 2.0 in a Nutshell,” O'Reilly Media, June 2005
3. Behrouz A. Forouzan, “Data Communications and Networking,” Fourth Edition, TMH.
4. James F. Kurose & Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet,” 3rd Edition, Pearson Education.

Course Code	B.Tech. III Year I Semester Course Title	L	T	P	Credits
IT531PE	Full Stack Development Lab (Professional Elective - I Lab)	0	0	2	1

Course Description: This lab course implements fast, efficient, interactive, and scalable web applications using a run-time environment using the full-stack components.

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

C531.1: Design flexible and responsive Web applications using Node JS

C531.2: Perform CRUD operations with MongoDB on a huge amount of data.

C531.3: Use various full-stack modules to handle HTTP requests and responses.

C531.4: Develop real time applications using react and Angular components.

List of Programs

Cycle 1:

1. Create an application to setup node JS environment and display "Hello World".
2. Create a Node JS application for user login system.
3. Write a Node JS program to perform read, write, and other operations on a file.
4. Create a food delivery website where users can order food from a particular restaurant listed on the website for handling http requests and responses using NodeJS.
5. Implement a program with basic commands on databases and collections using MongoDB.
6. Implement CRUD operations on the given dataset using MongoDB.
7. Perform Count, Limit, Sort, and Skip operations on the given collections using MongoDB.

Cycle 2:

8. Develop an angular JS form to apply CSS and Events.
9. Develop a Job Registration form and validate it using angular JS.
10. Write an angular JS application to access JSON file data of an employee from a server using $http service.
11. Develop a web application to manage student information using Express and Angular JS.
12. Write a program to create a simple calculator Application using React JS.
13. Write a program to create a voting application using React JS
14. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.
15. Build a music store application using react components and provide routing among the web pages.

REFERENCE BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley, 2019.
2. Mark Tielens Thomas, "React in Action", 1st Edition, Manning Publications.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT532PE	Data Mining Lab (Professional Elective -I Lab)	0	0	2	1

Course Description: This lab course provides hands-on experience in implementing and analyzing various data mining techniques and algorithms, such as data preprocessing, pattern discovery, classification, clustering, and outliers.

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

C532.1: Apply preprocessing methods to any given raw data.

C532.2: Implement various data mining algorithms in order to discover frequent patterns in massive datasets.

C532.3: Implement classification algorithms such as Bayesian, and decision trees.

C532.4: Implement clustering algorithms and find outliers.

List of Programs

Cycle 1:

1. Demonstrate various data pre-processing techniques for a given dataset.
2. Demonstrate different visualization techniques.
3. Implement dimensionality reduction using Principal Component Analysis (PCA) method.
4. Implementation of Decision Tree Classifiers.
5. Calculate information gain measures in a given dataset.
6. Implementation of Bayesian classifier for a given dataset.

Cycle 2:

7. Implementation of Apriori algorithm
8. Implementation of FP Growth algorithm.
9. Classification of data using K – nearest neighbor approach.
10. Implement K – means clustering algorithm.
11. Implement DBSCAN clustering algorithm.
12. Find the outliers in the datasets.

TEXT BOOK

1. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques", 3rd Edition, Elsevier.

REFERENCE BOOKS

1. Ian H. Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques", Second Edition, Morgan Kaufmann, 2005.
2. Margaret H Dunham, “Data Mining Introductory and Advanced topics”, PEA
3. Arun K Pujari, “Data Mining Techniques”, Universities Press, 3rd Edition.

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT533PE	**Mobile Application Development Lab (Professional Elective – I Lab)**	0	0	2	1

Course Description: This lab course provides a solid foundation for building innovative and functional Android applications, through a combination of theoretical concepts and hands-on projects.

Course Outcomes: At the end of the course, the students will be able to

C533.1: Design Android User Interface using Layouts and components
C533.2: Design android applications using menus, notifications and files
C533.3: Apply different data persistence techniques in Android development, including local file storage and SQLite databases.
C533.4: Develop Android application using Shared Preferences based on maps.

List of Experiments

Cycle 1:

1. (a) Create an Android application that shows Hello + name of the user and run it on an emulator.

   (b) Create an application that takes the name from a text box and shows hello message along with the name entered in the text box, when the user clicks the OK button.

2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date picker), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.

3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.

4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.

5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.

6. Create an application that uses a text file to store usernames and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with a Login Failed message

Cycle 2:

7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.
9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.
10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.
11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.
12. Create an application to find Current Location using location based services

TEXT BOOKS

1. Reto Meier "Professional Android 4 Application Development", Wiley India, (Wrox), 2012.
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage, 2013.

REFERENCE BOOK

1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013.

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
IT534PC	Software Testing Methodologies Lab (Professional Elective-I Lab)	0	0	2	1

Course Description: This lab course provides the knowledge of software testing methods, testing and management of automation using the latest software testing tools.

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

C534.1: Design and develop the best test strategies in accordance with the development model.

C534.2: Design and develop GUI, Bitmap and database checkpoints.

C534.3: Develop database checkpoints for different checks.

C534.4: Perform batch testing with and without parameter passing.

List of Programs

Cycle 1:

1. Recording in context sensitive mode and analog mode
2. GUI checkpoint for single property
3. GUI checkpoint for single object/window
4. GUI checkpoint for multiple objects
5. a. Bitmap checkpoint for object/window
   b. Bitmap checkpoint for screen area
6. Database checkpoint for Default check
7. Database checkpoint for custom check

Cycle 2:

8. Database checkpoint for runtime record check
9. a. Data driven test for dynamic test data submission
   b. Data driven test through flat files
   c. Data driven test through front grids
   d. Data driven test through excel test
10. Batch testing without parameter passing
11. Batch testing with parameter passing
12. Data driven batch
13. Silent mode test execution without any interruption
14. Test case for calculator in windows application

TEXT BOOKS

1. Dr. K. V. K. K. Prasad, “Software Testing Tools”, Dreamtech**.**
2. Baris Beizer, “Software Testing Techniques”, Second edition, Dreamtech

REFERENCE BOOKS

1. Brian Marick, “The craft of software testing”, Pearson Education.
2. Edward Kit,” Software Testing in the Real World”, Pearson Education.
3. Perry, “Effective methods of Software Testing”, John Wiley.
4. Meyers, “Art of Software Testing”, John Wiley.
5. SPD,”Software Testing Techniques”, O’Reilly

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
EN505HS	ADVANCED COMMUNICATION SKILLS LAB	0	0	2	1

OBJECTIVES:

The course should enable the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment while acquiring the necessary skills to make a smooth transition from campus to Corporate.

Exercise-I

Main Topics: Thinking Skills, Personality Development, self confidence and assertiveness,
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise-II

Main Topics: Group Discussion: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise-III

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting one's strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise-IV

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity

Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)

Writing Input: Writing to Define - Writing an effective SOP.

Exercise-V

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.

Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)

Writing Input: Writing to Record - Writing minutes of meeting.

REFERENCE BOOKS

1. Madhavi Apte , "**A Course in English communication**", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, **"Body Language- Your Success Mantra**", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills",** New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004

Web Sources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

OUTCOMES:

By the end of the course students will be able to

1. Demonstrate effective time and stress management techniques while being assertive and setting short term and long term goals.
2. Identify problems and construct argument in given case studies and write abstracts.
3. Analyze and assess their skills, strengths, weaknesses and face interviews confidently and be able to draft resumes.
4. Adapt to corporate culture by personal and professional sensitivity and also be able to draft an effective SOP.
5. Design a mini-live project by collecting and analyzing data and making oral and written presentations.

B.Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
CS506PC	**UI Design- Flutter**	**0**	**0**	**2**	**1**

Course Description: This lab course provides hands-on experience in creating visually appealing and responsive user interfaces using the Flutter framework. Participants learn to build cross-platform applications with a single codebase, utilizing Flutter's widget-based architecture to craft beautiful designs for both iOS and Android platforms. The lab emphasizes practical skills in UI development, enhancing proficiency in Flutter's rich set of tools and components.

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

C506.1:	Apply the basics of the Dart programming language, Flutter Widgets.
C506.2:	Create responsive UI Widgets using navigator in Flutter Applications.
C506.3:	Implement a form with various input fields and animations, along with validation and error handling.
C506.4:	Demonstrate Flutter Application using REST API and Flutter debugging tools.

List of Programs

Cycle 1:

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.
5. a) Design stateful and stateless widgets.
   b) Implement state management using set State and Provider.
6. a) Create custom widgets for UI elements.
   b) Apply styling using themes and custom styles.

Cycle 2:

7. a) Design a form with various input fields.
   b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
   b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
    b) Use Flutter's debugging tools to identify and fix issues.

REFERENCE BOOKS

1. Marco L. Napoli, “Beginning Flutter: A Hands-on Guide to App Development”.
2. Eric Windmill, “Flutter in Action”.
3. Alessandro Biessek, “Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2”.
4. Paul Deitel, Harvey Deitel, “Flutter Cookbook”.
5. Prajyot Mainkar , “Google Flutter Mobile Development Quick Start Guide: Get up and running with iOS and Android development”.

B. Tech. III Year I Semester

Course Code	Course Title	L	T	P	Credits
MC508	INTELLECTUAL PROPERTY RIGHTS	3	0	0	0

Course Description: To provide the students with the conceptual framework and the theories underlying Organizational Behaviour.

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

C508.1: Understand the fundamental aspects of Intellectual property Rights who are going to play a major role in development and management of innovative projects in industries.

C508.2: Examine Trademarks, Acquisition of Trade Mark Rights and its registration processes.

C508.3: Evaluate various aspects relating to copyrights and its procedure for registration processes.

C508.4: Evaluate with the Trade Secret Law, protection for submission, Unfair Competition.

C508.5: Evaluate on the International Developments in Intellectual Property Rights.

C508.6: Interpret about current trends in IPR and the steps taken by the Government of India in fostering IPR.

Unit – I Introduction to Intellectual property

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit – II Trade Marks

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Unit – III Law of copy rights

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit – IV Trade Secrets

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

Unit – V New development of intellectual property

New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT601PC	Automata Theory and Compiler Design	3	0	0	3

Course Description: This course provides knowledge and skills necessary to understand the structure of programming languages, design compilers, and analyze the computational aspects of various language constructs.

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

C601.1: Understand the concept of abstract machines for language recognition.

C601.2: Construct regular expressions and design context free grammars for formal languages.

C601.3: Design Pushdown Automata for Languages.

C601.4: Design Turing Machines for Languages.

C601.5: Design and implement parsers using LEX and YACC tools.

C601.6: Apply syntax-directed translation methods, generate intermediate code

Unit – I Introduction to Finite State Machines

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.
Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.
Deterministic Finite Automata: Definition of DFA, How a DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA.

Unit – II Regular and Context Free Languages

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions, Closure Properties of Regular Languages.
Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.
Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages, Closure Properties of Context Free Languages.

Unit– III Push Down Automata and Turing Machines

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state.
Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine.

Unit–IV Introduction to Compilers

Introduction: The structure of a compiler
Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex
Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers.

Unit – V Syntax-Directed Translation and Run-Time Environments

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code

TEXT BOOKS

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory, Languages, and Computation”, 3rd Edition, Pearson Education.
2. Mishra and Chandrashekaran, “Theory of Computer Science- Automata languages and computation”, 2nd Edition, PHI.
3. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson.

REFERENCE BOOKS

1. Kamala Krithivasan, Rama R, “Introduction to Formal languages Automata Theory and Computation”, Pearson.
2. K.V.N.Sunitha, N.Kalyani, “Formal Languages and Automata Theory”, Pearson.
3. John C Martin, “Introduction to Languages and The Theory of Computation”, TMH.
4. John R. Levine, Tony Mason, Doug Brown, “lex & yacc”, O’Reilly
5. Kenneth C. Louden, Thomson, “Compiler Construction”, Course Technology.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT602PC	**Machine Learning**	3	0	0	3

Course Description: This course introduces the basic concepts and techniques of Machine Learning with thorough understanding of the Supervised and Unsupervised learning techniques and its differences. The course elucidates the principles of evolutionary computing algorithms, ensembling techniques for increased prediction accuracy, and enlightens the principles of Reinforcement learning.

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

C602.1	Understand the basic concepts of Machine Learning Techniques.
C602.2	Evaluate various supervised, unsupervised learning algorithms with ensemble techniques.
C602.3	Apply the neural network concepts with Perceptron and Back Propagation.
C602.4	Make use of Dimensionality Reduction concepts for model building.
C602.5	Apply evolutionary computing algorithms approach for search and optimization.
C602.6	Analyze the concepts of Reinforcement Learning for building autonomous systems.

Unit-I Introduction to Learning

Learning- Types of Machine Learning, Design a Learning System, Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search, Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability.

Unit –II Supervised and Unsupervised Learning

Linear Regression, Support Vector Machines, Learning with Trees, Decision Trees, Constructing Decision Trees Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Basic Statistics, Gaussian Mixture Models, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms.

Unit–III Multilayer Perceptron- Going Forwards, Going Backwards

The Brain and the Neuron, Multilayer Perceptron– Going Forwards, Going Backwards: Back Propagation Error, Multilayer Perceptron in Practice, Examples of using the MLP, Overview, Deriving Back Propagation, Radial Basis Functions and Splines, Concepts, RBF Network, Interpolations and Basis Functions

Unit-IV Dimensionality Reduction and Evolutionary Learning

Curse of Dimensionality, Dimensionality Reduction, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Isomap, Least Squares Optimization Evolutionary Learning, Genetic algorithms, Genetic Offspring: Genetic Operators, Using Genetic Algorithms.

Unit-V Reinforcement Learning

Reinforcement Learning, Overview, Getting Lost Example Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Methods.

TEXT BOOK

1. Stephen Marsland, “Machine Learning, An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC, Machine Learning and Pattern Recognition Series.

REFERENCE BOOKS

1. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2017.
2. Marco Gori, Alessandro Betti, Stefano Melacci, “Machine Learning A Constraint, Based Approach”, 2023.
3. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press.
4. Jason Bell, “Machine learning–Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014
5. Ethem Alpaydin, “Introduction to Machine Learning”, 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT603PC	**Embedded Systems**	**3**	**0**	**0**	**3**

Prerequisites: Digital Electronics, Computer Organisation and Microprocessor

Course Description: This course deals with basic concepts in embedded systems, embedded software development, firmware engineering, IoT solutions.

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

C603.1: Distinguish the embedded systems from general purpose processing systems.

C603.2: Choose suitable hardware and memory, based on specifications.

C603.3: Differentiate processor and controller architectures and their interfacing mechanisms.

C603.4: Choose appropriate communication interfaces and protocols for on board communication.

C603.5: Design programs in assembly and 'C' languages to achieve specific functionalities.

C603.6: Analyze the techniques and issues in Task synchronization and communication in embedded firmware.

Unit – I Embedded Systems

Introduction to Embedded Systems, Processor embedded into a system, Embedded Hardware units and devices in a system, embedded software in a system, Design process of an embedded system, classification of embedded systems, characteristics, and quality attributes of embedded systems.

Unit – II Processor/Microcontroller

Introduction to processor/microcontroller architecture, Real world interfacing, processor and memory organization, memory types, memory maps and addresses, interrupt sources and interrupt service mechanism.

Unit – III On board Communication Basics

Serial communication devices, Parallel devices, Wireless devices, Real time clock, Serial bus communication Protocols-I2C, SPI, Parallel bus communication-ISA, PCI.

Unit – IV Embedded Firmware Development

Overview of programming concepts - in assembly language and in high level language C, C Program elements- Heads, Source files, Processor Directives, Macros, Functions, Data types and Data Structures.

Unit – V OS Based Embedded Systems

OS services - Process/Task Management, Memory Management, I/O subsystem manager, and Inter Process/Task communications - Tasks, Task states, Shared data, Signals, Message Queues, Mailbox, Pipes, and concepts of Semaphores.

TEXT BOOKS

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill.
2. Shibu K V, "Introduction to Embedded Systems," Second Edition, Tata McGraw-Hill.

REFERENCE BOOKS

1. Frank Vahid and Tony Givargis, "Embedded Systems Design - A Unified Hardware / Software Introduction", John Wiley.
2. Lyla, "Embedded Systems", Pearson.
3. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT604PC	Compiler Design Lab	0	0	2	1

Prerequisite Programming for Problem Solving

Course Description: This lab course deals with DFA, regular expression recognition, symbol table, lexical analysers, YACC specifications for syntactic categories, type checking, and storage allocation strategy implementations. It also delves into the creation of parsers, ensuring a comprehensive understanding of compiler design.

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

C604.1: Understand finite state machines and regular languages.

C604.2: Implement symbol table, lexical analyser and YACC.

C604.3: Implement type checking and storage allocation strategies.

C604.4: Implement top down and bottom up parsers for parsing programming language construct.

List of Programs

Cycle 1:

1. Write a program for acceptance of a string using a given DFA.

2. Write a program to accept/reject strings for the following regular expressions.
   a. 10 + (0 + 11)0*1
   b. 0*1 + 10
   c. (a+b)* c (a+b)*

3. Implement a symbol table program to perform insertion, display, deletion, search, and modification operations
4. Develop a lexical analyser in C to recognize a few patterns (ex. Identifiers, constants, comments, operators etc.)
5. Implementation of lexical analyser using lex tool. (ex. Identifiers, constants, comments, operators etc.)
6. Generate YACC specification for the following syntactic categories.
   a. Program to recognize a valid arithmetic expression that uses operator +, -, *
   b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
   c. Implementation of calculator.
7. Convert the BNF rules into YACC form and write code to generate Abstract Syntax Tree.

Cycle 2:

8. Write a C program to implement Type Checking for a given expression.
9. Recursive Descent Parser for the following grammar:
   E->E+T
   E->T
   T->T*F
   T->F
   F->(E)/id.
10. Implement any one Storage Allocation Strategies (heap, stack, static).

11. Write a C program to calculate „first‟ and follow ‟ function for the grammar
    E->E+T
    E->T
    T->T*F T->F
    F->(E)/id
12. Write LR (0) Parser for the following grammar.
    E->E+T
    E-> T
    T-> T*F T-> F
    F-> (E)/id

TEXT BOOK

1. Alfred, V., S. Monica, Sethi Ravi, and Ullman Jeffrey D, “Compilers Principles, Techniques”, (2007)

REFERENCE BOOKS

1. John R. Levine, Tony Mason, Doug Brown, “lex & yacc”, O’Reilly.
2. Louden, Thomson, “Compiler Construction”.

B. Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT611PE	Biometrics (Professional Elective – III)	3	0	0	3

Prerequisites: Data Structures

Course Description: This course explores concepts of biometrics procedures, benefits, and constraints associated with different multimodal biometric characteristics.

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

C611.1: Understand the architecture, design, and applications of biometric systems.

C611.2: Analyze face recognition systems using neural network.

C611.3: Examine the processes of iris segmentation and localization, and evaluate the applications of iris biometrics.

C611.4: Apply vein pattern, fingerprint biometrics and evaluate the modalities.

C611.5: Implement SIFT algorithm for hand geometry and Indian sign language recognition.

C611.6: Illustrate Biometric Cryptography and Multimodal Biometrics with its application.

Unit – I Biometrics

Introduction, history, type of Biometrics, General Architecture of Biometric Systems, and Basic Working of biometric Matching, Biometric System Error and performance Measures, Design of Biometric Systems, Applications of Biometrics, and Benefits of Biometrics Versus Traditional Authentication Methods.

Unit – II Face Biometrics

Face Biometrics & Retina and Iris Biometrics Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, Face Recognition Methods, Advantages and Disadvantages, Performance of Biometrics.

Unit – III Retina and Iris Biometrics

Design of Retina Biometrics, Iris Segmentation Method, Determination of Iris Region, Experimental Results of Iris Localization, Applications of Iris Biometrics, Advantages and Disadvantages.

Unit – IV Vein, Fingerprint Biometrics and Hand Gesture Recognition for ISL

Vein and Fingerprint Biometrics & Biometric Hand Gesture Recognition for Indian Sign Language. Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages, Basics of Hand Geometry, Sign Language, Indian Sign Language, SIFT Algorithms- Practical Approach Advantages and Disadvantages.

Unit – V Biometric Cryptography and Multimodal Biometrics

Introduction to Biometric Cryptography, General Purpose Cryptosystem, Modern Cryptography and Attacks, Symmetric Key Ciphers, Cryptographic Algorithms, Introduction to Multimodal Biometrics, Basic Architecture of Multimodal Biometrics, Multimodal Biometrics using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, AADHAAR: An Application of Multimodal Biometrics

TEXT BOOK

1. G R Sinha and Sandeep B. Patil, “Biometrics: concepts and applications”, Wiley, 2013.

REFERENCE BOOKS

1. Paul Reid, “Biometrics for Network Security”, Pearson Education India, 2004.
2. John D. Woodward and Jr. Wiley, “Biometrics, the Ultimate Reference”, Dreamtech.
3. Samir Nanavathi, Micheal Thieme and Raj Nanavathi, “Biometrics, Identity verification in a networked world”, Wiley, Dreamtech.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT612PE	**E-COMMERCE (Professional Elective – III)**	3	0	0	3

Course Description: This course provides the concepts of E-commerce applications, electronic payment systems, digital library, marketing strategies, web and mobile based applications for e business revenue models.

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

C612.1: Understand the foundational concepts and principles of e-commerce applications.

C612.2: Analyse different types of Electronic Payment Systems and Electronic Data Interchange in facilitating Organizational Commerce.

C612.3: Explore various forms in digital advertising and marketing campaigns.

C612.4: Evaluate the effectiveness and usability of multimedia solutions in electronic commerce.

C612.5: Apply Web Marketing strategies and internet technologies for e-business.

C612.6: Analyse effective business Revenue Model strategies, Virtual Communities for web and mobile commerce.

Unit – I Foundations of E-Commerce

Electronic Commerce-Framework, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications. Consumer Oriented Electronic commerce - Mercantile Process models.

Unit – II Electronic Payment Systems

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems. Inter Organizational Commerce - EDI, EDI Implementation, Value added networks. Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

Unit – III Advertisement and Marketing on the Internet

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research. Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering. Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing‟s, Desktop video conferencing.

Unit-IV Web Marketing Strategies

Web Marketing Strategies, Communicating with Different Market Segments, Beyond Market Segmentation: Customer Behaviour and Relationship Intensity, Advertising on the Web, E-Mail Marketing, Search Engine Positioning and Domain Names, Selling to Businesses Online, Electronic Data Interchange, Supply Chain Management Using Internet Technologies, Electronic Marketplaces and Portals.

Unit – V E-Business

E-Business Revenue Models, Revenue Models for Online Business, Changing Strategies: Revenue Models in Transition, Revenue Strategy Issues for Online Businesses, Creating an Effective Business Presence Online, Web Site Usability, Virtual Communities, Mobile Commerce, Online Auctions.

TEXT BOOK

1. Kalakata, Whinston, “Frontiers of Electronic Commerce”, Pearson.
2. Gary P. Schneider, “ECommerce Strategy Technology and Implementation”, Cengage Learning, India Edition.

REFERENCE BOOKS

1. Hendry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, John Wiley, “E-Commerce fundamentals and applications”.
2. Galgotia, S. Jaiswal “E-Commerce”.
3. Efrain Turbon, Jae Lee, David King, H. Michael Chang, “E-Commerce”.

B. Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT613PE	Data Analytics (Professional Elective – III)	3	0	0	3

Course Description: This course explores the fundamental concepts of analytics, its principles and methods using statistical analysis. It contains supervised and unsupervised models with estimation to discover interesting patterns and analyze its impact in business decisions. This also covers the various search methods and visualization techniques to carry out standard data visualization and formal inference procedures.

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

C613.1 Fetch data from various sources and make it ready for analysis.
C613.2 Visualize the data and interpret the insights that exist in the data.
C613.3 Make use of various tools and technologies for data analysis.
C613.4 Apply regression techniques to data and evaluate performance.
C613.5 Build supervised and unsupervised learning models for objective segmentation.
C613.6 Build models for time series and evaluate its performance.

Unit – I Data Management

Design Data Architecture and manage the data for analysis, Databases & Types of Data and Variables, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality, Missing Values, Redundant data, Inconsistent Data, Noisy, Outliers, Data Processing.

Unit – II Data Visualization

Need for Visulaization, Types of Visualization, Univariate Data Visualization- Univariate Statistics, Common Univariate Probability Distributions, Descriptive Bivariate Analysis- Two Quantitative Attributes, Two Ordinal Attributes, Descriptive Multivariate Analysis-Multivariate Frequencies, Multivariate Data Visualization, Infographics and Word Clouds.

Unit III – Data Analysis

Introduction to Analysis and Analytics, Tools and Environment, Application of Modeling in Business, Data Modeling Techniques, Missing Imputations, Need for Business Modeling.

Unit – IV Data Modelling

Introduction, Correlations and Relationships, Linear Regression, Blue property assumptions, Least Square Estimation, Non-linear regression, Logistic Regression, Advantages and Disadvantages of Regression Models, Analytics applications to various Business Domains.

Unit – V Objective Segmentation

Regression Vs Segmentation – Supervised Learning – Classification, Tree Building- Overfitting, Pruning and Complexity, Multiple Decision Trees, Unsupervised Learning-Clustering, Time Series Methods- Arima, Measures of Forecast Accuracy, ETL approach, Extract features from generated model and analyze, Data Analytics Application for Text.

TEXT BOOKS

1. "Student's Handbook for Associate Analytics" – II, III, NASSCOM
2. João Mendes Moreira, André C. P. L. F. de Carvalho, Tomáš Horváth, "A General Introduction to Data Analytics",Wiley.
3. Anil Maheswaran, "Data Analytics, McGraw-Hill.

REFERENCE BOOKS

1. Julie Steele and Noah Iliinsky, "Beautiful Visualization, Looking at Data Through the Eyes of Experts", Oreilly.
2. Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", Stanford Univ,2019.
3. M. Zaki and W. Meira, "Data Mining and Analysis: Fundamental Concepts and Algorithms".
4. Steinbach and Kumar, "Introduction to Data Mining", Tan, Addison Wesley, 2006.
5. Han, Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT614PE	Principles of Programming Languages (Professional Elective-III)	3	0	0	3

Course Description: This course illustrates various constraints and their sustainability with respect to various programming languages.

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

C614.1: Understand the principles of programming domains and acquire the skills for expressing syntax, semantics in formal notation.

C61 4.2: Analyze the binding process relationship and type equivalence in programming scenarios.

C614.3: Identify and analyze the key design issues associated with subprograms.

C614.4: Determine the concepts of co-routines and abstract data types.

C614.5: Analyze various concurrency, exception handling and Event Handling.

C614.6: Explore the features of various programming paradigms.

Unit – I Principles of Programming Languages

Preliminary Concepts: Reasons for studying concepts of programming languages, programming domains, language evaluation criteria, influences on language design, language categories, language design trade-offs, implementation method, programming environments.

Syntax and Semantics: General problem of describing syntax and semantics, formal methods of describing syntax, attribute grammars, describing the meanings of programs.

Unit – II Names, Bindings, and Scopes & Data Types

Names, Bindings, and scopes – Introduction, names, variables, concept of binding, scope, scope and lifetime, referencing environments, named constants

Data Types – Introduction, primitive data types, character string types, user defined ordinal types, array, associative arrays, record, union, tuple types, list types, pointer and reference types, type checking, strong typing, type equivalence.

Expressions and Statements- Arithmetic expressions, overloaded operators, type conversions, relational and boolean expressions, short circuit evaluation, assignment statements, mixed-mode assignment.

Control Structures–Introduction, selection statements, iterative statements, unconditional branching, guarded commands.

Unit–III Subprograms and Blocks & Abstract Data Types

Subprograms and Blocks – Fundamentals of sub-programs, design issues for subprograms, local referencing environments, parameter passing methods, parameters that are subprograms, calling subprograms indirectly, overloaded subprograms, generic subprograms, design issues for functions, user defined overloaded operators, closures.

Coroutines Implementing Subprograms: General semantics of calls and returns, implementing simple subprograms, implementing subprograms with stack-dynamic local variables, nested subprograms, blocks, implementing dynamic scoping.

Abstract Data Types – The concept of abstraction, introductions to data abstraction, design issues, language examples, parameterized ADT, encapsulation constructs, naming encapsulations.

Unit – IV Concurrency & Exception Handling and Event Handling

Concurrency – Introduction, introduction to subprogram level concurrency, semaphores, monitors, message passing, java threads, concurrency in function languages, statement level concurrency. **Exception Handling and Event Handling –** Introduction, exception handling in ada, c++, java, introduction to event handling, event handling with java and c#.

Unit – V Functional programming languages, Logic programming language & Scripting language

Functional Programming Languages – Introduction, mathematical functions, fundamentals of functional programming language, lisp, support for functional programming in primarily imperative languages, comparison of functional and imperative languages.

Logic Programming Language – Introduction, an overview of logic programming, basic elements of prolog, applications of logic programming.

Scripting Language – Pragmatics, key concepts, case study: python – values and types, variables, storage and control, bindings and scope, procedural abstraction, data abstraction, separate compilation, module library.

TEXT BOOKS

1. Robert. W.Sebesta" Concepts of Programming Languages",10/E, Pearson Education,.

2. D. A.Watt," Programming Language Design Concepts", Wiley Dreamtech,2007.

REFERENCE BOOKS

1. A.B. Tucker, R. E. Noonan, Programming Languages, 2nd Edition, TMH.

2. Programming Languages, K. C. Louden 2nd Edition, Thomson, 2003.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
CS600OE	**Problem Solving using Data Structures (Open Elective – I)**	3	0	0	3

Prerequisite Programming for Problem Solving

Course Description: This course covers linear and non-linear data structures. It also introduces various sorting techniques and pattern matching algorithms.

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

C600.1: Implement various operations on linear data structures to solve real world problems.

C600.2: Design solutions using Dictionaries and Hash Tables.

C600.3: Implement various kinds of operations on trees.

C600.4: Implement Traversing techniques in Graphs.

C600.5: Choose an appropriate sorting algorithm.

C600.6: Examine Pattern matching algorithms and Tries.

Unit – I Introduction to Data Structures

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations, Time complexity.

Unit – II Dictionaries

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching.

Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing, linear probing, and quadratic probing, double hashing, rehashing, extendible hashing.

Unit – III Trees

Trees: Terminology, Representation, Binary Tree - Implementation, Operations- Searching, Insertion and Deletion, Traversals.

Binary Search Trees: Definition, Implementation, Operations- Searching, Insertion and Deletion.

Unit –IV Graphs and Sorting

Graphs: Terminology**,** Implementation Methods. Traversal Methods.

Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

Unit – V Pattern Matching and Tries

Pattern Matching and Tries: Pattern matching algorithms-Brute force, Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, and Suffix tries.

TEXT BOOKS

1. E. Horowitz, S. Sahni and Susan Anderson Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press.
2. A. Tanenbaum, Y. Langsam, and M.J. Augenstein, “Data Structures using C” – PHI/Pearson Education.

REFERENCE BOOK

1. R. F. Gilberg and B.A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, Cengage Learning.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
CS601OE	**Introduction to Java Programming**	3	0	0	3

(Open Elective – I)

Course Description: This course covers Object oriented thinking, basics of java. Exceptions, multi threading, exploring various utilities and handling database & file management**.**

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

C601.1: Understand Object Oriented Programming concepts.

C601.2 Apply the basic constructs, Inheritance, packages and Interfaces.

C601.3 Make use of concepts of Exceptions to handle run time errors.

C601.4: Implement the concepts of multi threading.

C601.5: Utilize collection framework to implement various data structures

C601.6: Develop standalone applications using JDBC & file management

Unit – I Object oriented thinking and Java Basics

Object oriented Thinking and Java Basics- Class Hierarchies- Inheritance, Summary of OOP concepts.

History and Evolution of Java, Java buzzwords, data types, variables and arrays, operators, expressions, control statements, type conversion and casting, introducing classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, argument passing, recursion, nested and inner classes. String handling.

Unit – II Inheritance, Packages and Interfaces

Inheritance, Packages and Interfaces – Inheritance basics, using super, muliti level hierarchy, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASS PATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

Unit – III Exception handling and Multi threading

Exception handling and Multi-threading-- exception handling fundamentals, exception types, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronization, inter thread communication, thread groups, daemon threads. Enumerations, auto boxing, annotations, generics.

Unit – IV Collections Framework

The Collections Framework (java.util)- Collection Interfaces , List, Set, Queue, Deque, collection classes, Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, Dictionary, Hashtable , Properties.
More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

Unit – V JDBC & File Handling

Connecting to Database - JDBC drivers, connecting to a Database, preparing SQL statements, Querying a database and processing the results, updating data with JDBC.
Exploring java.io: streams- byte streams, character streams, Console class and sterilization.

TEXT BOOKS

1. Herbert Schildt, “Java the complete reference”, 7th Edition, TMH.
2. T. Budd, “Understanding OOP with Java”, updated edition, Pearson Education.

REFERENCE BOOKS

1.J.Nino and F.A. Hosch, John wiley & sons, “An Introduction to programming and OO design using Java”.
2. T. Budd, “An Introduction to OOP”, third edition, Pearson Education.
3. Y. Daniel Liang, “Introduction to Java programming”, Pearson Education.
4. R.A. Johnson- Thomson, “An introduction to Java programming and object-oriented application development”,
5. R. Buyya, S.T.Selvi, X.Chu, “Object Oriented Programming with Java”, TMH.
6. R. Nageswara Rao, “Core Java (an Integrated approach)”, DreamTech Press

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
CS602OE	**Fundamentals of AI (Open Elective – I)**	3	0	0	3

Prerequisite: Data Structures

Course Description: This course contains diverse branches of AI through a discussion of its theoretical foundations. At the end of the course the students shall have in-depth understanding of different knowledge representation formalisms and various techniques used for reasoning and learning.

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

C602.1: Identify suitable search agents for problem solving.

C602.2: Apply search techniques to solve problems in various domains

C602.3: Make use of mathematical logic to represent and reason to logical conclusi

C602.4: Illustrate knowledge schemes for various domains and reasons under uncertainty.

C602.5: Apply learning concepts and techniques to real-world problem-solving s

C602.6: Acquire knowledge acquisition techniques and methodologies for extracting domain knowledge from expert systems.

Unit – I

Introduction: AI History, Overview of AI application areas, AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents.
Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search).

Unit – II

Advanced Search: Constructing Search Trees, Stochastic Search, Minimax Search, Alpha-Beta Pruning.
Basic Knowledge Representation: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining.

Unit – III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non monotonic Reasoning, Other Knowledge Representation Schemes.
Reasoning Under Uncertainty: Basic probability**,** Introduction to Probabilistic Reasoning, Bayes Theorem, Acting Under Uncertainty, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

Unit- IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston‟s Learning Program, Decision Trees.

Unit – V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOKS

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education. 2021.
2. Patterson, “Artificial Intelligence and Expert systems”, Pearson Education.

REFERENCE BOOKS

1. Elaine Rich, Kevin Knight, Shivasankar B. Nair, “Artificial Intelligence”, Third Edition, The McGraw-Hill publications, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.
3. D. Poole and A. Mackworth. “Artificial Intelligence: Foundations of Computational Agents”, Cambridge University Press, 2010.

B. Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT605PC	Embedded Systems Lab	0	0	2	1

Course Description: This lab course is designed to acquired practical skills, technical knowledge, and professional competencies essential for careers in embedded systems engineering and related fields.

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

C605.1: Apply mathematical and logical operations to calculate timer values for generating specific time delays.

C605.2: Apply sensor integration and display handling through LCD, LED.

C605.3; Implement logic to mimic the behavior of a traditional dice roll and enable SSH server functionality.

C605.4: Demonstrate video capture through implement a simple static website and host it on the device using a web server.

The following experiments must be executed using

i) Microcontroller Kits (8051/ Raspberry Pi /Arduino).
ii) Use embedded C/ Python/ assembly language.

List of Experiments

Cycle 1:

1. Programs to perform arithmetic, logical, branching, and loop operations by a microcontroller.
2. Generate time delay using timers in a microcontroller.
3. Write a C program to count the number of times the switch is pressed and released.
4. Illustrate the use of a port header file (Port M) using an interface consisting of a keypad and LCD. Write a program to display "Hello world" on display of the receiving microcontroller using RS232. Flash the operating System onto the device into a stable functional state by porting desktop environment with away Packages necessary packages.
5. Program available GPIO Plus of the corresponding device using native programming language, interface LEDs and interface LED / Switches and test its functionality.
6. Using the light sensor, monitor the light intensity and automatically turn ON/OFF LED. (for Predefined threshold light intensity value)

Cycle 2:

7. Dice game simulation- generates a random value Similar to dice value and display the same using 16x2 LCD.
8. Export display to other system using available desktop display as display for the device using SSH client and X11 display seven.
9. Hosting a website on Board- Build and host a simple website (static) on the device and make it accessible online. (Need to install Sewn (e.g., Apache).)
10. Interface a regular USB webcam to the device and turn it into a fully functional IP webcam.

TEXT BOOKS

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill.
2. Shibu K V, "Introduction to Embedded Systems," Second Edition, McGraw-Hill.

REFERENCE BOOKS

1. Charles Bell," Beginning Sensor networks with Arduino and Raspberry Pi", Apress, 2013.
2. Frank Vahid and Tony Givargis, "Embedded Systems Design - A Unified Hardware/Software Introduction", John Wiley.
3. Lyla, "Embedded Systems", Pearson.
4. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000.

B.Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
IT606PC	**Machine Learning Lab**	**0**	**0**	**2**	**1**

Course Description: This lab implements fundamental statistical concepts using Python libraries. Various classification and regression model are built, which helps to gain practical experience in machine learning model selection and evaluation.

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

C606.1: Implement statistical concepts required for data analysis.
C606.2: Analyze data, model, model complexity and predict the trends.
C606.3: Correlate various machine learning algorithms along with their strengths and weaknesses
C606.4: Build predictive models from data and analyze the model performance.

List of Programs

Cycle 1:

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, and Standard Deviation.

2. Write a program to perform Arithmetic Array Operations (Addition, Subtraction, Multiplication, Division, Exponentiation, and Modulus) using Libraries such as Statistics, Math, Numpy and Scipy.

3. Implement and demonstrate the following by importing the dataset from load_ dataset.
   a. Pandas library function for data analysis & manipulation
   b. Matplotlib library functions for data visualization

4. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis for a given dataset.

['Sunny', 'Warm', 'Normal', 'Strong', 'Warm', 'Same', 'Yes']
['Sunny', 'Warm', 'High', 'Strong', 'Warm', 'Same', 'Yes']
['Rainy', 'Cold', 'High', 'Strong', 'Warm', 'Change', 'No']
['Sunny', 'Warm', 'High', 'Strong', 'Cool', 'Change', 'Yes']

Cycle 2:

5. a.Write a Python program to find out the correlation between Salary (dependent variable) and Experience (independent variable) using Simple Linear Regression.
   b. Using scikit-learn, perform House Price Prediction with Multiple Linear Regression (minihomeprices.csv)

6. Write a program to Predict Humidity using Decision Tree Algorithm. (daily_weather.csv)

7. Write a program to implement k-Nearest Neighbour classification algorithm using iris dataset.

8. Write a program to predict rainfall using Logistic Regression. (weatherAUS.csv)

9. Write a program to implement K-Means algorithm for clustering Mall customers (Mallcustomers.csv)

10. Build a Multi-Layer Perceptron (MLP) neural network model for Regression using Keras (minihomeprices.csv / housing.csv)

TEXT BOOK

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2017.

REFERENCE BOOK

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis, Second Edition.

B. Tech III Year II Semester

Course Code	Course Title	L	T	P	Credits
MC608	**Constitution of India**	3	0	0	0

Course Description: The students will be able to understand the history of Indian Constitution, and to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. It is to address the role of socialism in India after the commencement of the Bolshevik Revolution and develops the spirit of nationalism.

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

C608.1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

C608.2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

C608.3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

C608.4 Discuss the passage of the Hindu Code Bill of 1956.

C608.5 Understand the Parliamentary form of Government in India.

C608.6 Discuss the role and importance of Local Administration.

Unit – I History and Philosophy of the Indian Constitution

History of Drafting Committee, Preamble and Salient Features of the Indian Constitution.

Unit – II Contours of Constitutional Rights & Duties

Fundamental Rights: Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies ,Directive Principles of State Policy.Fundamental Duties.

Unit – III Organs of Governance

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit – IV Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit – V Election Commission

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Mahendra Pal Singh, V.N.Shukla's Constitution of India, Eastern Book Company, 2017.
3. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
4. J.N. Pandey, Constitutional Law of India, Central Law Agency, 2018.

B. Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT701PC	Information Security	3	0	0	3

Course Description: This course explores the fundamental aspects of network security services, cryptographic algorithms, and protocols, necessary for ensuring security in modern network environments. It also covers concepts of Digital Signatures, IP Security, Web Security, and Firewalls.

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

C701.1: Understand basic principles of security and symmetric ciphers.
C701.2: Apply public key encryption techniques, message authentication for secure data transmission.
C701.3: Implement secure authentication using digital signatures and protocols.
C701.4: Analyze the role of PGP and S/MIME to protect messages transmitted through E-mail.
C701.5: Apply IPSec, SSL/TLS, and SET for secure communication.
C701.6: Evaluate security threats, access control mechanisms and firewalls.

Unit – I Introduction and Symmetric Ciphers

Introduction: Security Attacks, Security Services and Security Mechanisms, A model for Internetwork security.

Symmetric Ciphers: Classical Encryption Techniques, DES, AES, Blowfish, RC4, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

Unit – II Asymmetric Key Ciphers and Message Authentication

Asymmetric Key Ciphers: Public key Cryptography Principles, RSA algorithm, Key Management, Diffie- Hellman Key Exchange, Elliptic Curve Cryptography.

Message Authentication and Hash Functions: Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

Unit – III Digital Signatures and Email Security

Digital Signatures: Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service

Email Security: Pretty Good Privacy (PGP) and S/MIME.

Unit – IV IP Security and Web Security

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Unit – V Intruders and Firewalls

Intruders: Intruders, Viruses and Worms Intruders, Viruses and related threats.

Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXT BOOKS

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.
2. Cryptography and Network Security by Behrouz A. Forouzan.

REFERENCE BOOKS

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

B. Tech. IV Year I Semester

Course Code	Course Title	T	P	Credits
IT702PC	Cloud Computing	0	0	3

Course Description: The course introduces computing paradigms, cloud architecture, deployment models, and technological drivers. It further explores virtualization, including CPU, memory, and I/O resource management with case studies on Xen, VMware, and Amazon EC2. The course also gives a comprehensive overview of cloud networking, security concerns, and advanced cloud computing trends.

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

C702.1: Understand computing paradigms, architectures and their management.
C702.2: Understand cloud service, deployment models, and the technological drivers.
C702.3: Apply virtualization techniques to optimize resource management and improve system efficiency in cloud computing environments.
C702.4: Develop cloud based software applications, utilizing various services from major cloud providers.
C702.5: Analyze the networking challenges in data centers and cloud computing environments.
C702.6: Identify cloud security issues and advanced computing concepts for secure and efficient cloud solutions.

Unit – I Introduction to Cloud Computing

Foundations of Cloud Computing: Traditional IT services, Computing Paradigms, Cloud Computing Fundamentals

Cloud Computing Architecture and Management: Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the cloud, Managing the Cloud, Migrating Application to Cloud.

Unit – II Cloud Models and Technological Drivers

Cloud Models: Cloud Deployment Models, Cloud Service Models.

Technological Drivers for Cloud Computing: SOA and Cloud, Multicore Technology, Web 2.0 and Web 3.0, Pervasive Computing, Operating System, Application Environment.

Unit – III Virtualization and Cloud Software Development

Virtualization and Development Strategies: Virtualization Opportunities, Approaches to Virtualization, Hypervisors, From Virtualization to Cloud Computing.

Programming Models for Cloud Computing: MapReduce, Cloud Haskell.

Software Development in Cloud: SaaS Introduction, Different Perspectives on Saas Development, New Challenges, Cloud-Aware Software Development using PaaS Technology.

Unit – IV Cloud Networking and Data Center Management

Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Load Balancing, Auto Scaling, Networking Issues in Data Centers, Transport Layer Issues in DCNs.

Cloud Service Providers: EMC, Google, Amazon Web Services, Microsoft, IBM, Salesforce, Rackspace, VMware, Manjrasoft.

Unit – V Security and Advanced Concepts in Cloud Computing

Security in Cloud Computing: Security Aspects, Platform-Related Security, Audit and Compliance

Advanced Concepts in Cloud Computing: Intercloud, Cloud Management, Mobile Cloud, Media Cloud, Interoperability and Standards, Cloud Governance, Computational Intelligence in Cloud, Green Cloud, Cloud Analytics, IAM Cloud, Service accounts.

TEXT BOOKS

1. Chandrasekaran, K. Essentials of cloud computing. CRC Press, 2014
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

REFERENCE BOOKS

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
4. https://cloud.google.com/sql/docs/introduction
5. https://docs.aws.amazon.com/pdfs/AmazonRDS/latest/UserGuide/rds-ug.pdf
6. https://docs.aws.amazon.com/pdfs/whitepapers/latest/aws-overview/aws-overview.pdf

B.Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
IT711PE	Human Computer Interaction (Professional Elective-IV)	3	0	0	3

Course Description: This course focuses on the principles and practices of designing effective user interfaces. It introduces the importance of good design, the history of screen design, and the characteristics of graphical and web user interfaces. Students will learn windows, multimedia elements, use of colors, and controls in interface design. The course also covers usability engineering, prototyping, cognitive models, and emerging technologies like Augmented and Virtual Reality.

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

C711.1 Elaborate the design of good Interface and features of GUI.
C711.2 Compare the Human interaction speed with computers.
C711.3 Apply visually pleasing composition of elements on screen design.
C711.4 Identify Various Navigation Schemes, Screen based controls in user interface design.
C711.5 Design and evaluate interactive product interfaces in the software process.
C711.6 Analyze cognitive models and their role in ubiquitous computing, augmented reality, and data visualization.

Unit – I Introduction

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design, A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Unit – II Design Process

Design Process – Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds, understanding business junctions. Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit– III Windows

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

Unit– IV HCI in the software process

HCI in the software process- The software life cycle, Usability engineering, Iterative design and prototyping, Design Focus: Prototyping in practice, Design rationale, Design rules, Principles to support usability Standards, Golden rules and heuristics, HCI patterns, Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method, Universal design, Universal design principles Multimodal interaction

Unit – V Cognitive models, Goal and task hierarchies Design Focus

Cognitive models Goal and task hierarchies Design Focus: GOMS saves money, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures, Ubiquitous computing and augmented realities, Ubiquitous computing applications research, Design Focus: Ambient Wood – augmenting the physical, Virtual and augmented reality, Design Focus: Shared experience Design Focus, Applications of augmented reality Information and data visualization**,** Multi modal interfaces, Improving user experience through AI

TEXT BOOKS

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech.
2. Human–Computer Interaction. Alan Dix, Janet Fincay, Gregory's, Abowd, Russell Bealg, Pearson Education.
3. Jean Vanderdonckt, Philippe Palanque, Marco Winckler, Handbook of Human-Computer Interaction, Springer Cham.

REFERENCE BOOKS

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen, Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

B. Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT712PE	High Performance Computing (Professional Elective - IV)	3	0	0	3

Course Description: The course introduces advanced computing architectures and parallel processing techniques to solve complex computational problems efficiently. It explores supercomputing environments, parallel algorithms, distributed systems, and optimization techniques. The course also introduces students to parallel computing paradigms, covering shared-memory and distributed-memory systems, with an emphasis on parallel programming through MPI and OpenMP. The course also explores GPU-based parallelism using CUDA, enabling students to design and evaluate efficient algorithms for computationally intensive applications.

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

C712.1: Understand modern processor architectures and optimize serial code for improved efficiency.
C712.2: Analyze parallel computing paradigms like shared, distributed, and hybrid systems
C712.3: Analyze the performance of parallel programs for shared-memory systems.
C712.4: Develop parallel programs for shared-memory systems using OpenMP.
C712.5: Design distributed-memory parallel programs using MPI with optimized communication.
C712.6: Implement GPU-based parallelism using CUDA and NVIDIA architectures.

Unit – I Modern Processors and Optimization Techniques

Modern Processors: Stored-Program Computer Architecture, General-Purpose cache-based Microprocessor Architecture, Memory Hierarchies, Multicore processors, Multithreaded processors, Vector processors.

Basic optimization techniques for serial code: Scalar profiling, Common sense optimizations, Simple measures, large impact, The role of compilers, Data access optimization.

Unit – II Parallel Computers

Parallel Computers: Taxonomy of parallel computing paradigms, Shared-memory computers, Distributed-memory computers, Hierarchical (hybrid) systems, Networks.

Basics of parallelization: Need for Parallelism, Parallel scalability.

Unit – III Shared-Memory Parallel Programming

Shared-memory parallel programming with OpenMP: Introduction to OpenMP, Profiling OpenMP programs, Performance pitfalls.

Case Study: OpenMP-parallel Jacobi algorithm.

Unit – IV Distributed-Memory Parallel Programming

Distributed-memory parallel programming with MPI: Message passing, Introduction to MPI, MPI performance tools, Communication parameters, Synchronization, serialization, contention, Reducing communication overhead.

Case study: Parallel sparse matrix-vector multiply.

Unit – V GPU Programming with CUDA

CUDA: Understanding the CUDA computing model and the API using nvcc compiler, Introduction to modern supercomputing architectures featuring NVIDIA processors, NGC and Docker containers for GPU-accelerated applications.

TEXT BOOKS

1. Introduction to Parallel Computing, Second Edition, AnanthGrama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003, ISBN: 0201648652
2. Introduction to High Performance Computing for Scientists and Engineers,Georg Hager, Gerhard Wellein,Chapman & Hall / CRC Computational Science series, 2011.
3. The Docker Book. Containerization is the new virtualization (2019) by Turnbull, James.

REFERENCE BOOKS

1. CUDA Programming A Developer's Guide to Parallel Computing with GPUs by Shane Cook, Morgan Kaufman Publishers
2. Parallel Computing – Theory and Practice, Second Edition, Michaek J. Quinn, Tata McGraw-Hill Edition.
3. Parallel Computers – Architectures and Programming, V. Rajaraman, C. Siva Ram Murthy, PHI.
4. Parallel Programming in C with MPI and OpenMP by Michael Quinn, McGraw-Hill Publisher
5. Computer Architecture A Quantitative Approach by John Hennessey and David Patterson, Morgan Kaufman Publishers

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT713PE	Quantum Computing (Professional Elective – IV)	3	0	0	3

Course Description: This course provides an introduction to quantum computing, its historical context and the importance of mathematics, physics, and biology. It covers foundational concepts in quantum mechanics, such as qubits, superposition, and entanglement, as well as mathematical tools like linear algebra and Hilbert spaces. It explores quantum circuits, quantum algorithms, and the relationship between quantum and classical complexity. The course also examines noise, error correction, and quantum cryptography, including quantum teleportation.

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

C713.1: Understand the basics of quantum computing.
C713.2: Apply mathematics, physics and biology concepts in quantum computing applications.
C713.3: Understand physical implementation of Qubit.
C713.4: Analyze quantum circuits with qubit gates and Bell states.
C713.5: Analyze quantum algorithms and their implementation.
C713.6: Understand the Impact of Quantum Computing on Cryptography.

Unit – I A History of Quantum Computing
Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations.

Unit – II Background Mathematics and Physics
Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Paul's exclusion Principle, Superposition, Entanglement and supersymmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma).

Unit – III Qubit
Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere.
single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

Unit – IV Quantum Algorithms
Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch’s algorithm, Deutsch’s-Jozsa algorithm, Shor’s factorization algorithm, Grover’s search algorithm.

Unit – V Noise and error correction

Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

TEXT BOOK

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

REFERENCE BOOKS

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT714PE	Wireless Networks & Mobile Computing (Professional Elective – IV)	3	0	0	3

Course Description: This course covers wireless communication technologies including medium access control, mobile IP, transport layer protocols, database management, data dissemination, synchronization techniques and fundamentals of mobile computing. It explores Mobile ad hoc networks (MANETs), routing algorithms, service discovery, and various mobile platforms.

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

C714.1: Comprehend the architectures and protocols of various wireless communication technologies.
C714.2: Analyze MAC protocols for wireless networks.
C714.3: Illustrate Mobile IP mechanisms and route optimization.
C714.4: Analyze TCP/IP adaptations for mobile environments.
C714.5: Analyze database management issues, data dissemination and synchronization methods.
C714.6: Explore MANET characteristics, routing algorithms, and service discovery.

Unit – I Introduction

Introduction to Network Technologies and Cellular Communications: HIPERLAN**:** Protocol Architecture, Physical Layer, Channel Access Control Sub-layer, MAC Sub-layer, Information Bases and Networking.

WLAN: Infrared vs. Radio Transmission, Infrastructure and Ad Hoc Networks, IEEE 802.11. Bluetooth: User Scenarios, Physical Layer, MAC layer, Networking, Security, Link Management.

GSM: Mobile Services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, and New Data Services, Overview of 5G.

Mobile Computing (MC): Introduction to MC, Novel Applications, Limitations, and Architecture.

Unit – II Wireless Medium Access Control

Motivation for a Specialized MAC- Hidden and Exposed Terminals, Near and Far Terminals, SDMA, FDMA, TDMA, CDMA. MAC Protocols for GSM, Wireless LAN (IEEE 802.11), Collision Avoidance- MACA, MACAW Protocols.

Unit – III Mobile IP Network and Transport Layer

Mobile IP Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. IP Multimedia Subsystem (IMS)

Unit – IV Data Issues, Dissemination and Synchronisation

Database Issues: Database Hoarding & Caching Techniques, Client–Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Methods, Multi-access Edge computing Server ,Data Synchronization–Introduction, Software, and Protocols, Digital Audio and Video Broadcasting (DAB & DVB).

Unit – V Mobile Ad hoc Networks (MANETs)

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Protocols and Platforms for Mobile Computing, Mobile Computing Use cases.

TEXT BOOKS

1. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley, 2002, ISBN 0471419028
2. Mobile Computing, Raj Kamal, Oxford University Press, 2007, ISBN: 0195686772.
3. Mobile Communications, Jochen Schiller, Addison-Wesley, Second Edition, 2004.

REFERENCE BOOK

1. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza Behravanfar, Cambridge University Press, Oct 2004, ISBN: 0521817331

Course Code	B.Tech. IV Year I Semester	L	T	P	Credits
SM703MS	Course Title Organizational Behaviour	3	0	0	3

Course Description: To provide the students with the conceptual framework and the theories underlying Organisational Behaviour.

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

C703.1: Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour.
C703.2: Assess the potential effects of organizational level factors (such as structure, culture and change) on organizational behaviour.
C703.3: Critically evaluate the potential effects of important developments in the external environment (such as globalization and advances in technology) on organizational behaviour.
C703.4: Analyse organizational behavioural issues in the context of organizational behaviour theories, models and concepts.
C703.5: Analyse Group Behavioural influence in an organization
C703.6: Analyse working with different people from different cultural and diverse background in the workplace.

Unit – I Introduction to Organizational Behaviour

Organizational Behaviour (OB)- Definition, Nature and Scope –Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organisational Behaviour. Cognitive Processes-I : Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization - Social perception – Attribution Theories – Locus of control –Attribution Errors –Impression Management.

Unit – II Cognitive Processes-II

Personality and Attitudes - Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction and organisational commitment-Motivational needs and processes- Work Motivation Approaches Theories of Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotional Intelligence – Self-Efficacy.

Unit – III Dynamics of OB-I

Communication – types - interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision making techniques – creativity and group decision making . Dynamics of OB –II: Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

Unit – IV Dynamics of OB –III

Power and Politics: Meaning and types of power – empowerment - Groups Vs. Teams – Nature of groups –dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place.

Unit – V Leading High performance

Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High performance work practices - Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

TEXT BOOKS

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
2. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009.
3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008.

REFERENCE BOOKS

1. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008.
2. Hitt: Organizational Behaviour, Wiley, 2008
3. Aswathappa: Organisational Behaviour, Himalaya, 2009

Course Code	B. Tech. IV Year I Semester Course Title	L	T	P	Credits
CS700OE	Scripting Languages (Open Elective – II)	3	0	0	3
Prerequisite	Programming for Problem Solving				

Course Description: This course contains Script Programming Paradigm. Languages like Ruby, Perl and TCL components.

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

C700.1:	Comprehend typical scripting languages and typical system
C700.2:	Understand the concepts of Perl.
C700.3:	Acquire programming skills in Advanced Perl, Interfacing Different operating System Security Issues.
C700.4:	Develop the Ruby based web applications.
C700.5:	Understand the process of embedding Ruby Script with other languages.
C700.6:	Understand the TCL and Tk Programming concepts.

Unit – I

Introduction to Scripts and Scripting: Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages.

PERL- Names and Values, Variables, Scalar Expressions, Control Structures, Arrays and Lists, Hashes, Strings, Patterns and Regular Expressions, Subroutines.

Unit – II

Advanced PERL: Finer points of looping, Pack and unpack, file system, eval, Data Structures, Packages, Modules, Objects, Interfacing to the operating system, Creating Internet-aware applications, Dirty Hands Internet Programming, Security Issues.

Unit – III

Introduction: A Tour of Ruby

The structure and Execution of Ruby Programs: Lexical Structure, Syntactic Structure, File Structure, Program Encoding, Program Execution.

Ruby Tk – Simple Tk Application, Widgets, Binding events, Canvas, Scrolling

Unit – IV

Extending Ruby: Ruby Objects in C, the Jukebox Extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

Unit – V

TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, Input/Output, Procedures, Strings, Patterns, Files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, Trapping errors, Event driven programs, Making applications Internet-aware, Nuts and Bolts Internet Programming, Security Issues-Running Untrusted Code, C Interface.
Tk: Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk

TEXT BOOKS

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly
3. Programming Ruby, The Pramatic Progammers guide by Dabve Thomas Second edition

REFERENCE BOOKS

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J.Lee and B. Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E. Quigley, Pearson Education.
3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
5. Perl Power, J. P. Flynt, Cengage Learning.

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
CS701OE	**Database Management Systems (Open Elective-II)**	3	0	0	3

Course Description: The course focuses on database management systems, its architecture and various applications. This course contains the topics related to conceptual data modelling, relational data model, relational query languages, relational database design and transaction management and files. The course also focuses on the fundamentals of knowledgebase and relational database management systems, and the current developments in database theory and the practice.

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

C701.1: Understand the basic concepts of DBMS
C701.2: Design conceptual models using ER Diagram and normalize the model
C701.3: Impose constraints on relations
C701.4: Implement the procedural and non-procedural languages on database
C701.5: Understand the recovery and concurrency control techniques
C701.6: Describe file organization techniques and tree-based indexing structures.

Unit – I

Introduction to Database Management Systems: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

Database Design and ER Model: Entities, Attributes, Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Database Design and ER Diagrams, Conceptual Design with the ER Model.

Unit – II

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form.

Relational Model: Introduction to Relational Model, Constraints on the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design.

Unit – III

Formal Relational Query Languages: Relational Algebra, Relational Calculus- Tuple relational Calculus, Domain relational calculus.

Structured Query Language: Form of basic SQL query, DDL Commands, DML Commands, UNION, INTERSECT and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, Introduction to views, destroying/altering tables and views, triggers and active databases.

Unit – IV

Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation-Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

Unit – V

File Organization: Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes-Intuitions for tree Indexes, Indexed Sequential Access Methods(ISAM), B+Trees: A Dynamic Index Structure.

TEXT BOOKS

1. Database System Concepts, Silberschatz, Korth, McGraw-Hill,V edition.3rd Edition
2. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata McGraw-Hill

REFERENCE BOOKS

1. Database Systems Design, Implementation, and Management, Peter Rob & Carlos Corone l7th Edition.
2. Fundamentals of Database Systems, Elmasri and Navathe, Pearson Education
3. Introduction to Database Systems, C.J.Date, Pearson Education
4. Oracle for Professionals, TheXTeam, S.Shah and V.Shah, SPD.
5. Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M.L. Gillenso

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
CS702OE	**Machine Learning (Open Elective-II)**	3	0	0	3

Course Description: The course introduces the basic concepts and techniques of Machine Learning with a thorough understanding of the Supervised and Unsupervised learning techniques. This course elucidates the principles of evolutionary computing algorithms, ensembling techniques for increased prediction accuracy, and enlightens the principles of Reinforcement learning.

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

C702.1: Understand the basic concepts of Machine Learning Techniques.

C702.2: Apply the neural network concepts with Perceptron and Back Propagation.

C702.3: Evaluate various supervised, unsupervised learning algorithms with ensemble techniques.

C702.4: Make use of Dimensionality Reduction concepts for model building.

C702.5: Apply evolutionary computing algorithms approach for search and optimization.

C702.6: Analyze the concepts of Reinforcement Learning for building autonomous Systems**.**

Unit – I

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept earning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants: – Perceptron – Linear Separability – Linear Regression.

Unit – II

Multi-layer Perceptron– Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

Unit – III

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms.

Unit – IV

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization
Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms.

Unit – V

Reinforcement Learning – Overview – Getting Lost Example Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

TEXTBOOKS

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series.

REFERENCE BOOKS

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw-Hill Education, 2017.
2. Marco Gori, Alessandro Betti, Stefano Melacci, Machine Learning A Constraint-Based Approach, 2023.
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
4. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
5. EthemAlpaydin ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT703PC	Information Security Lab	0	0	2	1

Course Description: This lab course provides hands-on experience in symmetric, asymmetric cipher algorithms, user key distributions, certificate-based authentication, trusted secure web transaction and Message Authentication Codes for secure data transmission.

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

C703.1: Apply appropriate cryptographic techniques to encode and decode the given text.
C703.2: Develop solutions using symmetric key algorithms.
C703.3: Build solutions using public key cryptographic algorithms.
C703.4: Apply appropriate secure hash algorithms to generate hash keys.

List of Programs

Cycle 1:

1. Implementation of symmetric Cipher Algorithm (AES and RC4).
2. Random number generation using a subset of digits and alphabets.
3. Implementation of RSA based signature system.
4. Implementation of Subset sum.
5. Authenticating the given signature using the MD5 hash algorithm.
6. Implementation of Diffie-Hellman algorithm.
7. Implementation of the ELGAMAL cryptosystem.

Cycle 2:

8. Implementation of Goldwasser-Micali probabilistic public key system.
9. Implementation of Rabin Cryptosystem.
10. Implementation of Kerberos cryptosystem.
11. Implementation of a trusted secure web transaction.
12. Digital Certificates and Hybrid (ASSY/SY) encryption, PKI.
13. Message Authentication Codes.
14. Elliptic Curve cryptosystems.

TEXT BOOK

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

REFERENCE BOOKS

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

B.Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
IT704PC	Cloud Computing Lab	0	0	2	1

Course Description: This lab focuses on the design and implementation of cloud computing environments, covering virtualization, cloud deployment, and resource management. Students will configure virtual machines, deploy applications on cloud platforms, work with cloud storage and databases, and simulate cloud scenarios using CloudSim.

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

C704.1	Design and configure virtualized environments using VirtualBox, VMware, and cloud instances.
C704.2	Implement and deploy applications on cloud platforms such as Amazon EC2, Google App Engine, and OpenStack.
C704.3	Develop and simulate cloud-based solutions using CloudSim and scheduling algorithms.
C704.4	Set up and manage cloud storage and databases using Amazon RDS, Google Cloud SQL, and Hadoop.

List of Experiments

Cycle 1:

1. Install Virtualbox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance.
4. Install Google App Engine. Create a hello world app and other simple web applications using python/java.

Cycle 2:

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.
9. Create a database instance in the cloud using Amazon RDS.
10. Create a database instance in the cloud using Google Cloud SQL

TEXT BOOKS

1. Chandrasekaran, K. Essentials of cloud computing. CRC Press, 2014
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

REFERENCE BOOKS

3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
4. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
5. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
6. https://cloud.google.com/sql/docs/introduction
7. https://docs.aws.amazon.com/pdfs/AmazonRDS/latest/UserGuide/rds-ug.pdf
8. https://docs.aws.amazon.com/pdfs/whitepapers/latest/aws-overview/aws-overview.pdf

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT811PE	Intrusion Detection Systems (Professional Elective – V)	3	0	0	3

Course Description: This course covers the fundamentals of computer and network security, focusing on threat landscapes, vulnerability assessment, firewalls, and VPNs. It explores various types of attacks across the network, application, and human layers, as well as classes of attackers. It also covers Intrusion Detection and Prevention Systems (IDS/IPS), including signature-based and anomaly detection methods, attack trees, malware detection, and security issues like obfuscation and insider threats.

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

C811.1: Understand fundamental knowledge of intrusion detection and prevention.
C811.2: Understand different types of attacks in network layer and code injection human layer.
C811.3: Design signature-based IDS solutions using Snort.
C811.4: Develop expertise in cybersecurity through anomaly detection techniques.
C811.5: Analyze different anomaly detection algorithms.
C811.6: Understand foundational knowledge of cybersecurity concepts.

Unit – I Introduction

The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention, Network and Host-based IDS

Unit – II Classes of attacks

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sop Hesitated groups-Automated: Drones, Worms, Viruses, Anomaly Based, Signature-based and Hybrid.

Unit – III IDS Models

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS.

Unit – IV Anomaly Detection

Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection, Acre Intrusion, Detection Next-Generation, Intrusion-Detection Expert System (NIDES Tools: Cisco NGIPS, BluVector, Snort,Zeek).

Unit – V Attacks

Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware detection - Obfuscation, polymorphism- Document vectors, Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero day detection-Insider, Threat issues-Taxonomy-

Masquerade and Impersonation Traitors, Decoys and Deception-Future: Collaborative Security um teleportation

TEXT BOOKS

1. Peter Szor, The Art of Computer Virus Research and Defense, Symantec Press ISBN 0-321-30545-3.
2. Markus Jakobsson and ZulfikarRamzan, Crimeware, Understanding New Attacks and Defenses.

REFERENCE BOOKS

1. Saiful Hasan, Intrusion Detection System, Kindle Edition.
2. Ankit Fadia, Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT812PE	Blockchain Technology (Professional Elective – V)	3	0	0	3

Prerequisites: Information Security, Distributed Databases

Course Description: The Blockchain Technology Course introduces the fundamentals of Blockchain Technology,describes its functionality using bitcoin and other cryptocurrencies and explores various types of blockchain such as private Blockchain,public blockchain and consortium blockchain.It analyzes the security issues of Blockchain.It also focuses on Blockchain platform using python and Hyperledger Fabric.

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

C812.1: Understand the basics of Blockchainand Cryptocurrency.
C812.2: Demonstrate the working principles of public blockchains such as Bitcoin and Ethereum.
C812.3: Analyze Private blockchain system and Consortium blockchain.
C812.4: Understand Initial Coin Offerings and Blockchain fundraising methods.
C812.5: Analyze the security issues of blockchain technology.
C812.6: Develop Hyperledger Fabric application using Python and JDK.

UNIT-I Fundamentals of Blockchain

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency- Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency,

Cryptocurrency basics, types of Cryptocurrencies, Cryptocurrency usage.

UNIT-II Public Blockchain System, **Smart Contracts**

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

Unit – III Private Blockchain System & Consortium Blockchain

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Need of Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.
Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

Unit – IV Security in Blockchain, Applications of Blockchain

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

UNIT-V Case Studies, Blockchain Platform using Python, Hyperledger Fabric

Blockchain Case Studies: Case Study 1 – Fintech, Case Study 2 – Healthcare, Case Study 3 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain Platform using Hyperledger Fabric: Introduction, Components of Hyper ledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

TEXT BOOKS

1. Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhilash K A and Meena Karthikeyan, Universities Press.
2. Blockchain Blueprint for Economy, Melanie Swan, SPD O'Reilly.
3. Blockchain Applications, Arshdeep Bahga,Vijay Madisetti 1st Edition

REFERENCE BOOKS

1. Michael Juntao Yuan, Building Blockchain Apps, Pearson, India.
2. Blockchain for Business,Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson.

B.Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
IT813PE	Deep Learning (Professional Elective-V)	3	0	0	3

Course Description: This course introduces deep learning concepts along with the basics of machine learning. It covers learning algorithms, optimization techniques and model performance. The course also discusses large-scale applications in computer vision, natural language processing, and speech recognition, emphasizing the real-world impact of deep learning.

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

C813.1: Understand the fundamentals of Machine Learning and Deep Learning
C813.2: Apply Regularization Techniques to improve model generalization and performance
C813.3: Understand the Convolutional Neural Network and its parameters
C813.4: Apply Convolutional Neural Networks to solve computer vision tasks
C813.5: Analyze RNN Architecture for solving problems involving sequential data and long-term dependencies.
C813.6: Explore Advanced Applications for large-scale tasks such as computer vision, NLP etc.

Unit – I Machine Learning Basics and Deep Feed forward Networks

Machine Learning Basics

Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Transfer Learning, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Deep Feedforward Networks Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

Unit – II Regularization for Deep Learning and Optimization for Training Deep Models

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier

Optimization for Training Deep Models: Learning Vs Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates.

Unit – III Convolutional Networks

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

Unit – IV Sequence Modeling: Recurrent and Recursive Nets

Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for LongTerm Dependencies, Explicit Memory.

Unit – V Practical Methodology and Applications

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyper-parameters, Debugging Strategies, Applications:Multi-Digit Number Recognition,E-commerce Product recognition.

TEXT BOOKS

1.Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2.The Elements of Statistical Learning. Hastie, R. Tibshirani, and J. Friedman, Springer.

REFERENCE BOOKS

1.Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.
2.Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
3.Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4.Golub, G., H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
5.Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT814PE	Software Process & Project Management (Professional Elective – V)	3	0	0	3

Course Description: This course explores software process maturity to understand process improvement and change. It delves into software project management, covering economics, life-cycle phases, and artifact sets in model-based architectures. Students learn about workflows, milestones, and pragmatic planning techniques for effective process management. The course also addresses project organization structures, metrics, and automation for monitoring and control. Additionally, it examines a case study, modern project profiles, and future trends in software project management practices.

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

C814.1: Analyze the Software process maturity levels for Process Improvement and Process Assessment.
C814.2: Explore the Software Management Renaissance in Economics.
C814.3: Evaluate Life cycle phases and artifacts in Project Management.
C814.4: Examine the role of workflows and checkpoints in process planning.
C814.5: Illustrate the importance of Project Organization, Project Control and process instrumentation in Project management.
C814.6: Evaluate the Project management practices with Case Studies.

Unit – I Software Process Maturity

Software Process Maturity Software maturity Framework-Software Process improvement, Process maturity levels,People in the Optimizing process,The need for the Optimizing process, Principles of Software Process Change-Process in perspective,The six basic principles,Some common misconceptions about the software process, A strategy for implementing software process change, Software Process Assessment.

Unit – II Software Project Management Renaissance

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

Unit – III Workflows and Checkpoints of process

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments, Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

Unit – IV Project Organizations

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation, The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

Unit – V CCPDS-R Case Study

CCPDS-R Case Study and Future Software Project Management Practices, Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS

1. Managing the Software Process, Watts S. Humphrey, Pearson Education
2. Software Project Management, Walker Royce, Pearson Education

REFERENCE BOOKS

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
2. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman& Jennifer Greene, O'Reilly, 2006.
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson Education, 2004.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT821PE	Natural Language Processing (Professional Elective – VI)	3	0	0	3

Course Description: This course introduces the fundamentals of Natural Language Processing (NLP), focusing on the structure of words, documents, and parsing techniques. It covers syntactic and semantic parsing, ambiguity resolution, and multilingual challenges. Students will explore meaning representation systems, computational models, and language modeling techniques including N-Gram models and Bayesian approaches.

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

C821.1: Understand word and document structures using morphological models.
C821.2: Apply syntactic parsing techniques, including treebanks and parsing algorithms.
C821.3: Analyze ambiguity resolution models and multilingual issues.
C821.4: Explore various semantic parsing approaches and meaning representation techniques
C821.5: Construct predicate-argument structure and meaning representation systems for parsing.
C821.6: Evaluate different language modeling techniques, including N-gram models, Bayesian topic models, and cross-lingual approaches.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models.

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches, Features for Text and Speech.

UNIT - II

Syntax: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms: Shift-Reduce Parsing, Hypergraphs and Chart Parsing, Minimum Spanning Trees and Dependency Parsing.

UNIT – III

Syntax: Models for Ambiguity Resolution in Parsing-Probabilistic Context-Free Grammars, Generative Models for Parsing, Discriminative Models for Parsing, Multilingual Issues-Tokenization, Case, and Encoding,Word Segmentation, Morphology.

Semantic Parsing: Introduction, Semantic Interpretation- Structural Ambiguity, Word Sense, Entity and Event Resolution, Predicate-Argument Structure, Meaning Representation.

UNIT - IV

Semantic Parsing: System Paradigms-Semantic Search, Word Sense, Predicate-Argument Structure, Meaning Representation Systems

UNIT - V

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation, Language Model Adaptation, Transformers.

TEXT BOOKS

1. Multilingual Natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and ImedZitouni, Pearson Publication.
2. Natural Language Processing with Transformers, Revised Edition, Lewis Tunstall, Leandro von Werra, Thomas Wolf O'Reilly Media, Inc.

REFERENCE BOOKS

1. Speech and Natural Language Processing - Daniel Jurafsky& James H Martin, Pearson Publications.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

B.Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
IT822PE	Business Intelligence (Professional Elective – VI)	3	0	0	3

Course Description: This course covers Decision Support Systems (DSS), data mining, data warehousing, and business analytics which are important for effective decision-making in Business Intelligence.It explores KPIs, dashboards, and collaborative technologies, alongside AI applications. The course also addresses emerging trends like cloud computing and social networking.

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

C822.1: Understand key concepts of Decision Support and Business Intelligence(BI).
C822.2: Explore the role of Decision Support Systems in BI.
C822.3: Apply data mining techniques to extract insights from large datasets for business decision-making.
C822.4: Apply Data Integration for real time data warehousing.
C822.5: Analyze different performance metrics for Collaborative decision support.
C822.6: Assess AI technologies and emerging BI trends to enhance knowledge management and organizational decision-making.

Unit – I Decision Support and Business Intelligence

Decision Support : Managerial Decision-Making**,** Computerized Support for Decision Making The Concept of Decision Support Systems, A Framework for Business Intelligence (BI), BI Methodology,The Major Tools and Techniques of Managerial Decision Support.
Decision Making:Introduction and Definitions,Models, Phases of the Decision-Making Process.

Unit – II Modeling and Analysis

Decision Support System: Description, Decision Support System Characteristics and Capabilities, Decision Support System Classifications,Components of Decision Support Systems, The Data Management Subsystem,The Model Management Subsystem, Management Support Systems Modeling ,Structure of Mathematical Models for Decision Support ,Certainty , Uncertainty, and Risk, Management Support Systems Modeling with Spreadsheets, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking ,Decision Analysis with Decision Tables and Decision Trees, Simulation, Visual Interactive Simulation.

Unit-III Data Mining for Business Intelligence

Data Warehousing: Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction,Transformation,and Load (ETL) Processes, Real-Time DataWarehousing.

Data Mining: Concepts and Applications , Text Mining Concepts and Definitions ,Natural Language Processing Text Mining Applications,Text Mining Process,Text Mining Tools ,Web Mining Overview, Web Content Mining and Web Structure Mining.

Unit – IV Business Performance Management and Collaborative Decision Support

Business Performance Management (BPM): Overview,Strategize, Plan, Monitor, Performance Measurement, BPM Methodologies, BPM Technologies and Applications, Performance Dashboards and Scorecards.

Collaborative Decision Support: Making Decisions in Groups, Characteristics, Process, Benefits, and Dysfunctions, Supporting Group Work with Computerized Systems, Emerging Collaboration Tools: From VoIP to Wikis

Unit – V Knowledge Management and Intelligent Systems

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Roles of People in Knowledge Management.

Intelligent Systems: Concepts and Definitions of Artificial Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Virtual Worlds,Virtual Communities,Online Social Networking: Basics and Examples ,Cloud Computing and BI.

TEXT BOOKS

1. Rajiv Sabherwal, Business Intelligence, WileyPublications,2012.
2. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
3. Jiawei Han & Micheline Kamber, Data Mining–Concepts and Techniques, Elsevier, 4thEdition.

REFERENCE BOOKS

1. David Loshin, Business Intelligence –The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
2. Philo Janus, Stacia Misner, Building Integrated Business Intelligence. Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.
3. Carlo Verellis, Business Intelligence Data Mining and Optimization for Decision Making, Wiley Publications.
4. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill Edition, Tenth reprint 2007
5. W.H.Inmon, Building the Data Warehouse,Wiley Dreamtech India Pvt.Ltd.
6. Data Mining Introductory and Advanced topics, Margaret H Dunham, PEA.

B. Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT823PE	Augmented Reality and Virtual Reality (Professional Elective – VI)	3	0	0	3

Course Description: The course explores Augmented Reality (AR) and its foundational architectures, emphasizing computer vision and human interaction. It examines tracking technologies, interaction techniques, and display systems essential for AR applications. The course offers a comprehensive exploration of Virtual Reality (VR), covering the principles of light and optics, visual perception, and rendering techniques in virtual environments. It also addresses motion sensing and audio sensing, enhancing the immersive experience within virtual worlds.

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

C823.1: Understand the fundamentals of Augmented Reality, display technologies, and tracking systems.
C823.2: Comprehend computer vision techniques and interaction modalities to develop effective Augmented Reality applications.
C823.3: Understand the principles of Virtual Reality, geometric modeling, and the science of light and optics.
C823.4: Apply human vision and visual perception concepts to optimize visual rendering techniques for Virtual Reality Systems.
C823.5: Evaluate the impact of depth, perception of motion, color, and analyze visual rendering for creating realistic and immersive VR environments
C823.6: Apply motion, interaction, and auditory rendering in real and virtual worlds to create immersive experiences.

UNIT - I

Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields.
Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays
Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT - II

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.
Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction
Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT – III

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception

The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations

Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays.

UNIT - IV

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color

Visual Rendering: Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT - V

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

Interaction: Motor Programs and Remapping, Locomotion, Social Interaction

Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

TEXT BOOKS

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

REFERENCE BOOKS

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
5. SanniSiltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
IT824PE	Cyber Forensics	3	0	0	3
	(Professional Elective – VI)				

Course Description: This course introduces students to the principles, techniques, and tools used in digital forensics. It focuses on the identification, collection, preservation, analysis, and presentation of digital evidence. Emphasis is placed on the use of forensic tools, investigative techniques, and adherence to legal and ethical standards.

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

C824.1: Understand Cybercrime and Incident response Process.
C824.2: Understand the importance of the initial response phase and preserving digital evidence in a digital forensic investigation.
C824.3: Apply Forensics analysis and validation techniques for acquiring data from digital devices.
C824.4: Understand the foundational principles of network forensics in investigating cybercrimes.
C824.5: Apply methods for data collection from mobiles using appropriate tools.
C824.6: Analyze file system structures with respect to data integrity, security features, and performance.

Unit – I Introduction of Cybercrime and Incident response Process

Introduction of Cybercrime: Role of computers in crime, types of cybercrime, Worms versus viruses, Introduction to digital forensics.

Introduction to Incident Response Process: Incident Response Methodology- Pre-Incident Preparation, Detection of Incidents, Initial Response, Formulate a Response Strategy, Investigate the Incident, Reporting and Resolution.

Unit – II Initial Response and forensic duplication

Initial Response and forensic duplication: Initial Response, Data Collection from Windows systems, Data Collection from UNIX system.

Forensic Duplication: Forensic duplicates As Admissible Evidence, Forensic Duplication tool Requirements, Creating a forensic Duplicate and Qualified Forensic Duplicate of a Hard Drive.

Unit – III Forensics analysis and validation

Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions.

Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools- examining the honeynet project

Unit – IV Current Forensic tools, Cell phone and mobile device forensics

Current Forensic tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software.

E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

Unit – V File Organization

File Organization: Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS

1. Incident Response and computer forensics by Kevin Mandia, Chris Prosise, Tata McGraw Hill, 2006.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning.
3. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.

REFERENCE BOOKS

1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison-Wesley Pearson Education.
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
CS800OE	Operating Systems (Open Elective-III)	3	0	0	3

Course Description: This course explores Operating System functionality, system structure, process and memory management, scheduling, synchronization, deadlocks, virtual memory, and file system implementation.

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

C800.1: Understand basic concepts of operating system structure and functionalities.
C800.2: Compare scheduling algorithms for efficient CPU utilization
C800.3: Analyze synchronization techniques to solve concurrency problems.
C800.4: Apply appropriate algorithm for handling deadlocks
C800.5: Illustrate memory management techniques and virtual memory concepts.
C800.6: Implement allocation methods and free-space management.

Unit – I

Introduction: Operating System Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security.

System Structures: Operating System services, User OS Interface, System Calls, Types of System Calls, System Programs.

Process concepts: Process Scheduling, Operations on Process.

Unit – II

Multithreaded Programming: Overview, Multithreading Models.

Process Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.

Unit – III

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization.

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

Unit – IV

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

Virtual Memory: Demand Paging, Page Replacement-FIFO, Optimal,LRU, LFU.

Unit – V

File System and Implementation: File Concept, Access methods, Directory and Disk Structure, File Sharing, Protection, File System Structure, Allocation methods, Free-space Management.

TEXT BOOK

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 7th Edition, John Wiley.

REFERENCE BOOKS

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI.
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.
3. Operating System A Design Approach- Crowley, TMH.
4. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
5. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
6. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

Course Code	B.Tech. IV Year II Semester Course Title	L	T	P	Credits
CS801OE	Software Engineering (Open Elective – III)	3	0	0	3

Course Description: This course discusses principles of software engineering, process models and software requirements and also explores design principles, testing strategies and risks in software development.

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

C801.1: Illustrate software process framework and models
C801.2: Analyze requirements and validate the requirements.
C801.3: Choose an appropriate model to create an architectural design.
C801.4: Apply various testing strategies to verify the software quality.
C801.5: Illustrate the importance of framework for product metrics.
C801.6: Identify the risk strategy and QA techniques for developing quality software.

Unit – I

Introduction to Software Engineering: The Nature of Software, Software Engineering, The Software Process, Software myths.
A Generic Process Model: Defining a Framework Activity, Identifying a Task set, Process Pattern, the Capability maturity model integration (CMMI).
Process models: The waterfall model, Agile Development

Unit – II

Software Requirements: Functional and non-functional requirements, The Software requirements document.
Requirements Engineering: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements

Unit – III

Design Engineering: Design process and design quality, design concepts, the design model.
Creating an architectural design: software architecture, architectural styles, architectural design.
Conceptual model of UML: Class diagrams, Object diagrams, Sequence diagrams, Activity diagrams, Collaboration diagrams, Use case diagrams, Component diagrams, Deployment diagrams.

Unit – IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Metrics for Process and Products: Software measurement, metrics for software quality.

Unit – V

Risk management: Reactive vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.
Quality Management: Quality concepts, Software Quality Assurance, Formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill International Edition.
2. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.

REFERENCE BOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley.
2. James F. Peters, Witold Pedrycz, Software Engineering, An Engineering Approach, John Wiley.
3. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Education.
4. Meiler Page-Jones, Fundamentals of Object-Oriented Design using UML, Pearson Education.

B.Tech. IV Year II Semester

Course Code	Course Title	L	T	P	Credits
CS802OE	Computer Networks (Open Elective-III)	3	0	0	3

Prerequisites: Elements of Computer Science and Engineering, Data Structures

Course Description: This course covers concepts viz., basic taxonomy and terminology of the computer networking and enumerates the layers of OSI model and TCP/IP model. Design issues and Protocols related to Data link layer, Network layer, Transport layer and Application layer.

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

C802.1:	Analyze pros and cons of the components, reference models and various transmission media.
C802.2:	Analyze various link control and access control mechanisms available in the data link layer.
C802.3:	Grasp the foundational principles, challenges, and mechanisms of the network layer in computer networks.
C802.4:	Choose the appropriate routing algorithm suitable for the given network topology
C802.5:	Manage the networks to ensure efficient, reliable, and high-quality communication.
C802.6:	Assess the Transport layer protocols and the features of Application layer.

Unit – I

Introduction: Network hardware, Network software, Reference Models, Example Networks- Internet, and Wireless LANs: 802.11x.

Physical Layer: Guided Transmission media- twisted pairs, coaxial cable and fiber optics. Wireless Transmission-Electromagnetic Spectrum, Radio Transmission, Microwave Transmission and Infrared Transmission.

Data link layer: Data link layer Design issues, Error detection and correction.

Unit – II

Data Link layer: Elementary data link protocols Simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channels.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocol: SONET

Medium Access Control Sublayer: The channel allocation problem, Multiple access protocol- ALOHA, Carrier Sense Multiple Access protocols, Collision free protocols, Ethernet, Data link layer switching.

Unit – III

Network Layer: Network Layer Design Issues, Network Layer in the Internet: The IPv Protocol, IP Addresses, IPv6.

Routing algorithms: Shortest Path Algorithm, Flooding, Distance Vector Routing, Link Sta Routing, Hierarchical Routing, Broadcast, Multicast.

Unit – IV

Network Layer: Congestion Control Algorithms, Quality of Service, Internetworking, The Network Layer in the Internet- BGP.

Unit – V

Transport Layer: Transport Services, Elements of Transport protocols, The Internet Transpo protocols: TCP and UDP protocols.

Application Layer: The Domain Name System, Electronic Mail, The WORLD WIDE WE Streaming Audio and Video.

TEXT BOOK

1. Andrew S Tanenbaum, David. j. Wetherall, Computer Networks, 5th Edition. Pearson Education/PHI

REFERENCE BOOKS

1. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson
2. Behrouz A. Forouzan, Data Communications and Networking, Third Edition TMH.

SUSTAINABLE DEVELOPMENT GOALS

01 NO POVERTY

02 ZERO HUNGER

03 GOOD HEALTH AND WELL-BEING

04 QUALITY EDUCATION

05 GENDER EQUALITY

06 CLEAN WATER AND SANITATION

07 AFFORDABLE AND CLEAN ENERGY

08 DECENT WORK AND ECONOMIC GROWTH

09 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS